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ABSTRACT

This issue contains articles on the recombinant DNA controversy, the ethical principles of scientific institutions, and the effect of disaster novels on public opinion and technology assessment, as well as a guide to funding for science, technology and values projects, and a bibliography on professional ethics. In addition, 14 pages of news items related to science, technology, and human values are presented along with a meetings calendar and an addition to the general bibliography. (BB)

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WINTER 1979 ISSUE NO. 26

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SCIENCE, TECHNOLOGY, & HUMAN VALUES

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AN INTERDISCIPLINARY QUARTERLY REVIEW

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The Ethical Principles of Scientific Institutions,
by Don K. Price

Disaster Thrillers: A Literary Mode of Technology Assessment,
by John Woodcock

The rDNA Controversy: Archival and Oral History Resources,
by Charles Weiner

and featuring:

A Guide to Public Funding of STV Projects,
compiled by Vivien B. Shelanski

Publications on Professional Ethics in Science and Technology,
compiled by Albert Flores

with:
News Items,
General Bibliography, and
Meetings Calendar

SE 027 533

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News Items

A. Report on What Happens When the Proposal Is Denied

In an October 1978 report to the National Institutes of Health, a team of Rand Corporation researchers--Grace M. Carter, Wendy D. Cooper, Clara S. Lai, and Daniel S.M. March--describe the results of a fascinating survey of NIH grant applicants who did not receive funding for their biomedical proposals. In a time of increasingly tight Federal budgets, it is important to learn what effect an unsuccessful grant application may have on the individual investigator and, possibly, on the general progress of scientific research.

The Rand survey team conducted interviews with a sample of 126 investigators who had made 156 applications to the NIH (not counting amended applications) for support of 153 biomedical projects in FY1970 and FY1971. Of these projects, 22% were completed essentially as planned, some major or minor parts of 35% were eventually performed, and 43% were dropped entirely. Only 9% of the projects were completed as planned without any federal support.

The report points out that the short-term effects of an unfunded application may vary widely. In some cases, identical funding from another source may be forthcoming; if slightly less money is obtained, but the research goes forward according to the original design, then "there may be inefficiencies and delays in the production of the research, with the consequent inefficient use of highly trained scientific manpower and other resources."

The long-range effects of lack of funding are less well understood. Some investigators may, of course, abandon certain lines of research. There are also hidden "sunk" costs in the form of technician training, animal colonies, deterioration of equipment, and investment of the investigator's own training and preliminary work on the problem. 20% of the investigators sampled "have abandoned any formal biomedical research," although the report asserts that they found no evidence that "those who are no longer in research were less qualified than those who remain."

What about the effect on the early career of a researcher? Although two-thirds of the junior investigators in the sample currently have a supported research program, 30% of the junior investigators who were trying to obtain their first grant did give up formal biomedical research in the years following their unfunded application (the report does point out that almost all of them were MDs). Also, "those whose attempts to obtain a federal grant were not successful did change jobs more frequently than more successful junior investigators."

The study also gathered some data on the sampled researchers' perceptions of the way NIH policies, particularly those of the budget design process and peer review, affected not only their own research but also the national research effort. The majority of these unsuccessful applicants were still generally well disposed toward the peer review system. Many also found positive aspects to the experience:

a) Some participants believed that the experience improved their ability to prepare subsequent applications;
b) Some of those who had "substantially changed the direction of [their] research" cited the rewards of their current effort as one of the benefits derived from ending the previous line of research; and
c) A few felt that the quality of their research improved, finding that they could "produce equally good science while expending fewer resources."

The full 45-page report, The Consequences of Unfunded NIH Applications for the Investigator and His Research, Rand Report No. R-2229-NIH, has been published by the Rand Corporation, Santa Monica, CA 90406.

B. Ethics Advisory Board Begins Deliberations on Human in vitro Fertilization

Research involving human in vitro fertilization is the first item on the agenda of the recently established Ethics Advisory Board, permanent successor to the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research (a temporary body that was dismantled in October after four years of operation). Like its predecessor, the Ethics Advisory Board is comprised of representatives of a variety of disciplines, from science to law to ethics, as well as representatives of the "public interest."

In November and December, the Board held public hearings in different regions of the country to provide "an opportunity for interested members of the public to express their opinions. . .regarding the legal, ethical, scientific and social issues surrounding [Department of Health, Education, and Welfare] support of research and therapeutic applications of in vitro fertilization in humans." Although the hearings have now concluded, written materials may be submitted at any time (to the address given below) and will be distributed to all members of the Board.

Members of the Ethics Advisory Board are: James C. Gaither, J.D., chairman; David A. Hamburg, M.D., president, Institute of Medicine, co-chairman; Sissela Bok, Ph.D., Harvard University; Jack T. Conway, United Way of America; Henry W. Foster, M.D., Meharry Medical College; Donald A. Henderson, M.D., Johns Hopkins School of Hygiene and Public Health; Maurice Lazarus, Federated Department Stores, Inc.; Robert A. McCormick, S.T.D., Kennedy Institute for the Study of Reproduction and Bioethics; Robert F. Murray, M.D., Howard University College of Medicine; Mitchell W. Spellman, M.D., Harvard Medical School; Daniel C. Tosteson, M.D., Harvard Medical School; Agnes L. Williams, LL.B.; and Eugene Zweiback, M.D.

Meetings of the Ethics Advisory Board are open to the public. To request announcements and summary minutes, or to submit materials, write to: Dr. Charles R. McCarthy, Staff Director, Ethics Advisory Board, Westwood Building, Room 125, 5333 Westbard Avenue, Bethesda, MD 20016. Telephone: (301) 496-7776. For an account of an early hearing of the Board see: "Ethics Advisory Board Confronts Conception in the Test Tube," 202 Science (13 October 1978): 198-199.

C. APA Committee to Assemble Information on Ethics Rounds

The Committee on Philosophy and Medicine of the American Philosophical Association plans to compile information on one of the more interesting recent developments in the area of philosophy and medicine, the establishment of Ethics Rounds in hospitals. The Committee is anxious to receive reports on Ethics Rounds at various hospitals or plans for establishing them, and is soliciting descriptions of on-going series and practical ideas for making them work. The goal is to publish a brochure, containing the results of the investigation, that will be made available to groups or institutions planning Ethics Rounds. Information for (or inquiries about) this project should be directed to Rosalind Ekman Ladd, Department of Philosophy, Wheaton College, Norton, MA 02766, who has volunteered to edit the brochure. [See Newsletter Number 9 (Fall 1978) of the APA Committee on Philosophy and Medicine, for descriptions of three successful Ethics Rounds programs at Children's Hospital (Boston), Children's Hospital (San Francisco), and Rhode Island Hospital; available from the APA Office of the Executive Secretary, University of Delaware, Newark, DE 19711.]

D. National Commission on Research Established

Six educational groups have banded together to establish a National Commission on Research to examine and propose changes in the ways the federal government supports academic research. Director of the 12-member Commission is Cornelius J. Pings, of the California Institute of Technology. The group was formed in response to concerns about the increasingly strained relationship between the Federal government and the university research community. [See, for example, "Universities 'Battered' by Federal Regulators," 202 Science (1 December 1978): 955-956.]

According to Dr. Pings, the Commission's study is expected to last for about a year and to cover "the entire range of problems and controversies over how the federal government funds academic research." Topics on the Commission's agenda include: peer review and other criteria for funding; principles for the recovery of direct and indirect costs; duration of grant periods; extent of agency involvement with the substance of projects; and accountability on the part of the agency, the investigator, and the university for research results, and for expenditure of funds.

The Commission was established by the Association of American Universities, the National Academy of Sciences, the American Council on Education, the National Association of Land Grant Universities and Colleges, the Social Science Research Council, and the Council of Learned Societies.

The Commission, however, will operate independently of these bodies. Commission chairman is William H. Sewell (Professor of Sociology, University of Wisconsin, Madison, WI).

E. New Society to Focus on the Study of Professional Ethics

Drawing on a common concern for professionalism and ethics, a group of philosophers, lawyers, engineers and others are forming a Society for the Study of Professional Ethics. The Society hopes to provide a forum for discussion of the teaching of ethics and of issues in applied ethics, and to be a resource to groups as they prepare ethical codes or appoint ethics boards. A special all-day session featuring speakers and discussion was held at the December 1978 American Philosophical Association Eastern Division Meeting in Washington, DC. Persons interested in the Society should write to either Professor Sheri Smith, Rhode Island College, Providence, RI 02808; or Professor M.B. Montgomery, Drexel University, Philadelphia, PA 19104.

F. Ethics and Health Care Projects Initiated at Columbia University

Two new projects on ethical issues in health care have recently been funded at Columbia University's College of Physicians and Surgeons. "Ethical Issues in Psychiatry and Mental Health Care," supported by the van Ameringen Foundation, is a three-year study of the ethical and value issues in psychiatry. In addition to identifying the consequences of these issues for the quality of mental health care, the project will also develop educational materials for use by students in health-related programs, as well as by legislators, policy makers, and consumers.

In the second project, "Development of Educational Materials on Issues of Ethics and Values in Health Care," funded by the Edward Makkinckrodt, Jr., Foundation, an interdisciplinary team will examine clinical cases which raise significant ethical dilemmas. To generate teaching materials for students in the health professions, the case records will be put into written and videotape form together with comments of the individuals involved and analyses by project personnel. Additional information on both studies may be obtained from: Dr. Bernard Schoenberg, Associate Dean for Academic Programs, Columbia University, College of Physicians and Surgeons, 630 West 168th Street, New York, NY 10032.

G. Duke University Creates New Program on Science, Society, and Human Values

After more than a year of discussion and development, a specially-appointed interdepartmental task force at Duke University has organized an on-going faculty seminar series and an academic program on the interaction of science, society and human values. Although some details remain to be set, the Duke program in general aims at a structure within which a student can "examine science, medicine or technology from different perspectives to attain a reasonably comprehensive view of it in social, historical, intellectual and ethical terms."

The Duke solution to problems of prerequisites and distribution requirements commonly encountered in an interdisciplinary program was to devise a "3 x 3 Matrix Structure" of Areas ("science," "technology," or "medicine") and Approaches ("ethics," "analysis," or "policy"), and then to require a minimum of five courses distributed among at least two areas and all three approaches. This brief description of the Duke program cannot do justice to the entire program effort; for more information, contact: Seymour H. Mauskopf, Chairman-Coordinator of the Advisory Committee, Program in Science, Society and Human Values, Department of History, 6727 College Station, Duke University, Durham, NC 27708.

H. Bell Laboratories Building a Science, Technology, and Society Program

Bell Laboratories has established a Science, Technology, and Society Program to promote "mutually beneficial interactions between Bell Labs and scholars in the STS field." The Program, under the direction of Robert E. McGinn, encompasses a variety of activities:

1) Work is proceeding on the five-volume History of Engineering and Science in the Bell System, volume 2 of which was published in October 1978.

2) The STS Program also will aim to improve access to Bell's substantial archival holdings, including materials on the various areas of telecommunications research pursued at the laboratories. Inquiries about the availability and use of archival materials on topics of particular interest to scholars are welcome.

3) The Program will also assist scholars seeking technical information for research in telecommunications. For example, a scholar studying technological diffusion recently requested materials which might shed light on how knowledge of transistor technology was disseminated worldwide in the early 1950's.

The Program invites suggestions of possible STS conference topics that might be supported by Bell Labs (e.g., the significance of the research and development laboratory in American history), and welcomes suggestions on other potentially fruitful interaction (e.g., student internships, visits to Bell Labs, guest lectures at Bell Laboratories, university lectures by Bell scholars on STS topics, and various joint ventures in the STS field). Limited numbers of complimentary copies of the two history publications, Volume 1 ("The Early Years: 1875-1925") or Volume 2 ("National Service in War and Peace: 1925-1975"), are available, upon request, from: Dr. Robert E. McGinn, STS Program, Bell Laboratories - Room 3B-315, 600 Mountain Avenue, Murray Hill, NJ 07974.

I. Environment and Policy Institute Established at East-West Center in Honolulu

When a common environment is threatened or when financial or resource interdependencies increase interaction between nations, the need for understanding and communication also increases dramatically. However, the need for international communication on scientific or technical policy issues such as environmental issues does not disappear after a crisis is met. To foster involvement of scholars and professionals from the U.S. and nations of Asia and the Pacific in joint research and educational activities on problems of mutual concern and consequence, the East-West Center in Honolulu, Hawaii, has established an Environment and Policy Institute (EAPI).

In the past year, the Institute has begun work on a variety of activities--staff studies, advanced degree programs (allowing pursuit of graduate degrees at the University of Hawaii or from another University in a Joint Doctoral Research Intern Program), workshops, and conferences. Present plans are to increase the staff and to pursue specific study within the following general problem-oriented areas:

1) Development Financing--The ramifications of requiring an environmental assessment as a part of development decision-making.

2) Ocean Management--Potential areas for study include national and international policies pertaining to transport, fisheries resources, scientific research, and regional environmental management.

3) International Energy Resource Flows--The interdependence of nations with respect to adoption of energy strategies will be studied by the Resource Systems Institute (RSI) of the East-West Center; then, an EAPI-RSI collaborative effort will examine the global and national environmental dimensions of assessing the trade-offs among various energy options.

Director of the Institute is William H. Matthews. Address inquiries to: The East-West Environment and Policy Institute, The East-West Center, 1777 East-West Road, Honolulu, HI 96848.

J. Joint HSS-SAA-SHOT Committee to Study Problems of Science Archives

Discussions in May 1978 between archivists and historians in a workshop sponsored by the NSF History and Philosophy of Science Program revealed significant mutual ignorance about who generates records of value to the history of science, whose records are being adequately reviewed, what materials are not being archived, and whether special standards are needed for appraising scientific records. In a first step toward answering these questions, the History of Science Society, the Society of American Archivists, and the Society for the History of Technology have formed a joint committee to assess past and present model projects, recommend approaches and suggest specific research designs. Areas to be addressed by the Committee are: a) how to encourage creators of records to preserve them for archival appraisal; b) how to identify individuals and institutions currently holding important records; c) development of guidelines for appraising, processing and describing scientific and technological records; d) the best way to disseminate information about archival holdings; and e) assessment of scholarly use of scientific records.

Committee members designated by the societies are:

For the History of Science Society--David Bearman (American Philosophical Society Library), Clark Elliott (Harvard), and Patsy Gerstner (Dittrick Medical Museum);

For the Society of American Archivists--Maynard Brichford (University of Illinois), Helen Slotkin (M.I.T.), and Joan Warnow (American Institute of Physics); and

For the Society for the History of Technology--Robert Friedel (Smithsonian Institution), Richard Lytle (Smithsonian Institution), and Richmond Williams (Hagley Foundation).

The Committee invites comments by scholars in the history of science who use manuscript and archival sources. Committee chairman is David Bearman, American Philosophical Society Library, 105 South Fifth Street, Philadelphia, PA 19106.

K. Rockefeller Foundation Archives Made Available to Historians

The Rockefeller Archives Center in North Tarrytown, NY, recently opened to researchers the archives of the Rockefeller Foundation through 1957. Each January 1, data from another year will be made available. In addition, research grants (from $500 to $1000) are given each year to graduate students or advanced scholars wishing to work in any Rockefeller Archives Center collection. Inquiries should be sent to: The Director, Rockefeller Archives Center, Hillcrest, Pocantico Hills, North Tarrytown, NY 10591.

L. Science Journalism Bibliography Published by Austrian Communications Institute

Few efforts have been made to gather together the diffuse recent literature on the processes and problems of communicating science to the public. Publication of Wissenschaftsjournalismus is, however, a good first effort toward an international compilation of these sources. The authors, Erich and Ingrid Geretschlaeger, of the Institut für Publizistik und Kommunikationswissenschaft, have compiled articles from primarily Western European and English-language publications. The system of topic coding allows readers to search for only those articles on a specific subject (for example, journalism in the electronic media). Citations for the 613 entries are given in the language of publication; English translations are provided for all annotations and for the front matter.

The bibliography may be ordered from: Institut für Publizistik und Kommunikationswissenschaft, Universität Salzburg, Sigmund Haffnergasse 18, A-5020 Salzburg, Österreich/Austria. Price: öS 50 (Austrian shillings), or $4.00 (U.S. dollars). Checks should be made payable to: Salzburger Sparkasse, Kto. Nr. 66233 (Freunde des Instituts für Publizistik).

M. Status of Minorities in Engineering: A Progress Report

In 1974, when the National Research Council and the Assembly of Engineering established a Standing Committee on Minorities in Engineering, minority enrollment in engineering schools stood at 5.3% of the total enrollment. By Fall 1977, the proportion of minorities enrolled as freshmen in engineering schools was 8.6%. Formation and support of the NRC-NAE Committee represents a concerted effort by the academic and commercial engineering communities to encourage minority group members to enter the field of engineering, and acknowledges the importance of increasing those enrollment figures.

To date, the Committee has undertaken three types of activities:

1) Improving financial assistance to qualified students through the National Fund for Minority Engineering Students (NFMES) [In its first year of operation, NFMES provided aid to 84 students; in the 1977-78 academic year, grants were made to over 900];

2) Bringing together representatives from industry, education, and government to share related information and experiences; and

3) Collecting and publishing data, including a Bibliography on Employment of Minority Engineers, a Directory of Organizations in Engineering Activities for Minorities, and many reports and proceedings of workshops.

The Committee has recently published its First Annual Report, 1974-77, which is available upon request from the Committee on Minorities in Engineering, 2101 Constitution Avenue, N.W., Washington, DC 20418.

N. OTA Publishes Reports on Appropriate Technology, and Government and Innovation

Two useful reports have recently been released by the Office of Technology Assessment:

1) Selected Federal Programs in Appropriate Technology provides an overview of appropriate technology programs in twelve federal agencies. Agencies were asked to submit information about "programs which provide financial, technical or other assistance to local groups or individuals for appropriate technology activities," defined by the survey organizers as activities "that are decentralized or diversified, that are relatively simple or amenable to management by its users, or that are in harmony with the environment and our use of natural resources." For each program listed, information is given on: the person to contact; statutory basis, funding authorization, and appropriation levels for FY1978; location of the program within the agency; examples of specific activities or projects funded; eligibility requirements for those receiving assistance; and types of assistance available. Agencies covered in the information survey include the Departments of Agriculture, Commerce, Energy, HEW, HUD, Labor, and State; Community Services Administration; ACTION; Environmental Protection Agency; National Science Foundation; and Small Business Administration.

To obtain the 77-page survey, write to: Office of Technology Assessment, Research and Development Program, U.S. Congress, Washington, DC 20510.

2) Government Involvement in the Innovation Process is a report prepared for the OTA by MIT's Center for Policy Alternatives. The publication focuses on the relationship between government action and technological innovation in the civilian sector of the U.S. economy, and examines major factors currently influencing the process of introducing new goods and services in the U.S. (e.g., incentives and funding for basic research, tax and patent policies; regulations). It summarizes the approaches to technology policies in Japan, Great Britain, France, and West Germany, and assesses their applicability in this country; and identifies several options for the Congress to consider for facilitating innovation. Government Involvement in the Innovation Process (69 pages) is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. $2.50; stock number 052-003-00576-00.

O. New Journals Focus on Science in China and the USSR

The first issues of two new quarterly "translation journals" addressing critical issues in science, technology, and development policy will appear in Spring 1979.

Chinese Science and Technology, edited by Pierre M. Perrolle (Wheaton College), will provide continuing and current access to translations of official and unofficial documents from the People's Republic of China and occasionally of related documents from other sources such as Taiwan and Japan. Themes announced for early issues include:

- --determination of priorities for research and technological development;
- --ideological debates on the role of science and technology in society;
- --allocation of resources and the organization of scientific research; and
- --implications of scientific research in economic development and foreign relations.

Science and Technology in the USSR, edited by Thane Gustafson (Harvard University), will focus on technological innovation and on the social, political, and economic implications of technological development. The journal will include translations of major policy statements, news articles, scholarly papers, and book excerpts related to:

- --recruitment, training, and management of science personnel;
- --the role of scientists and technicians in policy formulation and implementation;
- --the shaping of priorities for research; and
- --controversies over theory, policy, and practice.

Requests for examination copies and additional information should be addressed to: M.E. Sharpe, Inc., 901 North Broadway, White Plains, NY 10603.

P. "NOVA" Teacher's Guides and Transcripts Available for 1979 Season

A guide to classroom use of the first six "NOVA" television programs for 1979 is now available from the "NOVA" office, (WGBH-Boston, 125 Western Avenue, Boston, MA 02134). The programs, in order of network transmission, will be: "Black Tide" (week of 1 January); "The Long Walk of Fred Young" (week of 8 January); "A World of Difference" (week of January 15); "The Mind Machines" (week of 22 January); "Cashing In on the Ocean" (week of 29 January); and "Patterns from the Past" (week of 5 February). For information on audio-visual distribution of these programs, write Charles Schuerhoff, Director of Distribution, WGBH-Boston, 125 Western Avenue, Boston, MA 02134. Written transcripts of individual programs are available approximately one month following network telecast, for $2.00 (single copy) and $1.00 (orders of 20 or more). To order a transcript, send check to: "[program title]," P.O. Box 1000, Boston, MA 02118. Allow 4 to 6 weeks for delivery.

Q. Publication Announcement: Encyclopedia of Bioethics

The Encyclopedia of Bioethics, a four-volume, 2000-page reference work containing more than 300 articles, has been published after six years of preparation. Development of the encyclopedia was supported by the National Endowment for the Humanities with matching funds from private foundations; Warren T. Reich, of Georgetown University's Kennedy Institute of Ethics served as Editor. Entries address various issues associated with the human value dimensions of health care and the life sciences: e.g., *in vitro* fertilization, experimentation with children, the right to health care, gene therapy, sociobiology, war and science, population ethics, abortion, and environmental health. Many articles examine basic concepts and principles such as informed consent, and there are also essays on bioethics in the major religions, the history of medical ethics, the philosophy of medicine, the sociology of science, and modern bioethical developments. Texts of important codes and statements related to medical ethics are also provided in the Appendix: codes for the practice of medicine, directives for human experimentation, patients' bills of rights, and codes of specialty health-care associations. *The Encyclopedia of Bioethics* is published by The Free Press, Box 200-D, Riverside, NJ 08370. The price is $200.

R. 4S Chooses Washington, DC, As Site for Next Meeting

The Society for the Social Studies of Science (4S) will hold its Third Annual Meeting in Washington, DC, on 2-4 November 1979. The Society is composed of approximately 500 scholars from diverse disciplines (including sociology, history, philosophy, political science, science policy, psychology, and anthropology) who share a common interest in the study of the internal development and macrosocial context of science. The theme of the next meeting, "Science and Public Policy," will be broadly interpreted to reflect the wide range of interests represented by the members. Persons interested in membership information should write to: Lowell Hargens, Department of Sociology, Ballantine Hall, Indiana University, Bloomington, IN 47401. For more information on the Washington meeting, write: Albert Teich, Graduate Program in Science, Technology and Public Policy, Georgetown University, Washington, DC 20052.

S. Second Annual Greater Boston Undergraduate Conference on Bioethics

On 24-25 March 1979, the Mendel Club at Boston College will sponsor the second annual Greater Boston undergraduate conference on bioethics at the Boston College campus in Chestnut Hill, MA. Undergraduate and graduate students from all fields, nursing and medical students, faculty members and other interested individuals in the New England area are invited to attend. The conference will consist of fourteen symposia on different areas of bioethical significance, at which undergraduates will deliver presentations and participate in discussions moderated by experts in the particular fields. Registration fees are $3.00 (students), $6.00 (others). For more information, write to: Maria Pezzi, Coordinator, Mendel Club, Higgins 611, Boston College, Chestnut Hill, MA 02167; (617) 969-0100, ext. 3545.

T. Workshop on Science, Technology, and Society: Instructional Aids, 26-27 March 1979

Science, Technology, and Society is one of the most rapidly growing fields of pedagogy in American higher education. This rapid growth and the extraordinary interdisciplinary nature of the subject matter require new teaching aids of all types (textbooks to visual materials). This Penn State workshop is directed at teachers of STS courses or those considering or planning such courses. Discussions will address questions of curriculum content, emerging trends in available resources, as well as existing instructional materials for all education levels.

Keynote speakers will include: F. James Rutherford (Assistant Director, NSF Science Education Directorate), John Truxal (College of Engineering and Applied Science, SUNY-Stony Brook), and E.G. Sherburne (Director, Science Service). The meeting will be held on the University Park Campus (State College, PA) of the Pennsylvania State University. For more information, write Philip H. Becker, 123 Steidle Building, The Pennsylvania State University, University Park, PA 16802.

U. Forthcoming Symposia on Philosophy and Technology

The American Catholic Philosophical Association meeting in Toronto, Canada, 20-22 April 1979 will feature a symposium arranged by Carl Mitchum (St. Catharine College) on "Philosophy, Technology, and Theology." The afternoon session includes two papers: E. Schuurman (Vrije University, Amsterdam), "Technology: Curse or Blessing?"; and Frederick Sontag (Claremont College), "Technology and Theodicy." Papers by Ernest Fortin (Boston College), "Augustine, the Arts, and Human Progress", and by Paul Durbin (University of Delaware), "Technology and Thomistic Natural Law Theory" highlight the evening session.

Edmund Byrne (Indiana University-Purdue University at Indianapolis) is arranging a philosophy and technology symposium for the APA Western Division meeting in Denver in April 1979. Papers will be presented by James Feibleman (Tulane University), Bernard Murchland (Ohio Wesleyan), and Alex Michalos (University of Guelph).

The APA Pacific Division meeting 23-25 March 1979 in San Diego also will include a philosophy and technology seminar. Phillip Fandozzi (University of Montana) is arranging this symposium and welcomes contributions of papers or volunteer commentators.

V. Science Indicators Seminar

The Institute for Scientific Information (ISI) will hold a two-day seminar on "Research Needs and Applications for Indicators Based on the Scientific and Technical Literature" in April 1979. Six speakers will present two sets of prepared papers at the NSF-funded program, which will be directed by H. Roberts Coward (ISI) and chaired by Toni Carbo Bearman (NFAIS). One session will consider indicator needs in science policy, survey the current state of our knowledge of the communication system of science, and evaluate the potential contributions of information science to the development of science indicators. A second session will consider appropriate analytical methods for relating data on the scientific literature to issues in the social study of science and science policy.

In addition to the selected speakers, twelve participants drawn from the science studies community will be invited to the seminar. ISI is, therefore, seeking nominations of individuals whose research interests and background in methods suggest that they have a potential for utilizing literature-based indicators in their work. These participants will have the opportunity to familiarize themselves with existing data on the scientific literature, identify indicators that can be based on that data, and consider the applications of such indicators in their own fields of research. Because a goal of the seminar is to expand application of literature-based indicators in science studies, most participants will not be drawn from the community of experienced bibliometricians. Invitations to participate will be extended on the basis of the individual's potential for contributing to critical aspects of the seminar and for finding indicator applications in science studies research.

Nominations or inquiries should include material on the prospective participant's background and training and a statement concerning research interests in the science studies area. Those interested should contact: Dr. H. Roberts Coward, Institute for Scientific Information, 325 Chestnut Street, Philadelphia, PA 19106.

W. Michigan State Conference on Philosophy and Economics

On 18-20 May 1979, the Department of Philosophy at Michigan State University (East Lansing) will sponsor a conference on "Philosophy and Economics," focusing on many of the basic theoretical and practical issues in contemporary economic activity and thought. The increasing economic problems of the 1970's have occasioned wide-spread rethinking of the foundations of economic theory, of the place of economic considerations in formulating social policy, and of the various ways economic concerns bear on social well-being. Such issues touch on the activity and problems of many disciplines other than philosophy and economics. This conference aims to promote interdisciplinary discussion of four broad topics:

a) Economic Justice (e.g., problems of distributive justice, justice and the market economy, and the reposing of economic questions in the light of recent debates on justice);

b) Method and Categories of Economic Studies (e.g., assumptions of neo-classical economics, political economy, theory of value, decision-making, and utility theory);

c) Work in an Industrial Economy (e.g., themes of labor and human nature, alienation, industrial democracy, and technology and the quality of work); and

d) Economics and Issues of Social Practice (e.g., problems in the application of economic concepts in regional planning, energy policy, and educational policy.

Papers should be submitted by 1 February 1979. For more information, write: Bruce Miller or Richard Peterson, Department of Philosophy, Morrill Hall, Michigan State University, East Lansing, MI 48824.

X. International Conference on Human Choice and Computers

The Second IFIP Conference on Human Choice and Computers will take place 4-8 June 1979 in Vienna, Austria. Fourteen invited speakers will explore computers and society as an emerging discipline; cultural issues; systems and organization; and computers and mass communications. Preprints of all invited papers will be mailed to participants before the conference. Conference co-chairmen are C.C. Gotlieb and Fred Margulies. Address inquiries to: IFIP Conference on Human Choice and Computers, Austrian Organizing Committee (Fred Margulies), P.O. Box 179, A-1013 Vienna, Austria.

Y. Hastings Center Plans Workshop on the Teaching of Ethics

As part of its project on the teaching of ethics in American higher education, The Hastings Center will hold a one-week workshop in New York City on the teaching of ethics. The July 1979 workshop will be limited to approximately 150 persons who teach ethics at different university and professional school levels and in different fields in ethics (e.g., ethics and journalism, pre-professional ethics, undergraduate "core curriculum" programs in ethics, law and engineering, etc.). It will have three specific goals: (1) to afford participants an opportunity for intensive reflection on theoretical and practical problems posed by the teaching of ethics; (2) to provide coherence and direction to the national efforts now underway to strengthen the teaching of ethics; and (3) to offer those teaching ethics an opportunity to share ideas with others in different fields.

The workshop faculty will be composed of experienced and prominent teachers of ethics, and will be supplemented by guest lecturers. The cost per participant will be approximately $335 plus travel; however, The Center does not expect to have funds for travel or subsidies.

The Hastings Center has also issued a progress report (8 pages) on its Teaching of Ethics project. Requests for the report, as well as additional information about the workshop, should be directed to: Dr. Arthur Caplan, The Hastings Center, 360 Broadway, Hastings-on-Hudson, NY 10706.

Z. Employment Announcement: Director of Center for Ethics and Human Values

A search is currently underway for a Director of a newly established Center for Ethics and Human Values, a joint project of Westminster College and The University of Western Ontario, London, Canada. The interdisciplinary Center addresses the ethical, social, legal, theological and philosophical dimensions of public policy, technology, and problems affecting the quality of human life and institutions. The Director's responsibilities will include: active involvement in and leadership of research activities of the Center, overall operation of the Center, preparation of budgets, grant proposals, and reports, recruitment and supervision of personnel, and collaboration with existing and developing academic programs in the University. The Director will participate in the planning of the Center's initial structure and make recommendations on suitable research directions to its governing board. This senior academic and administrative position will be available on or before 1 July 1979. Nominations and inquiries should include a curriculum vitae, list of publications, and names of three referees, and be addressed to: Mr. W. Lockwood Miller, Chairman, Search Committee, Center for Ethics and Human Values, Westminster College, London, Ontario N6G 2M2, Canada.

AA. Ethical Issues in Human Reproductive Technology: Analysis by Women

Under a grant from the NSF EVIST Program, the Federation of Organizations for Professional Women has begun work on a project to explore the effects of introducing alternative social values and perspectives, particularly those offered by women, into public and policy debates on research priorities and on the applications of basic research to reproductive technology. In an interdisciplinary summer workshop (24-29 June 1979) at Hampshire College (Amherst, MA), fifty scholars will present papers or commentaries and hold extensive discussions. Although many participants have been chosen, the project invites inquiries from additional persons in the natural and social sciences, ethics, law, medicine, health care, etc. Each participant will receive a stipend and expense reimbursement. For more information, write Dr. Becky Holmes, Project Director, 24 Berkshore Terrace, Amherst, MA 01002.

Meetings Calendar

2-3 March 1979	Society for the Advancement of American Philosophy, 6th Annual Meeting, John Carroll University, Cleveland, OH. Contact: John Howie, SIU, Carbondale, IL 62901.
8-10 March 1979	The 22nd Annual Missouri Valley History Conference, Omaha, NE. Program chairperson: Jacqueline D. St. John, M.V.H.C., Dept. of History, University of Nebraska at Omaha, Box 688, Omaha, NE 68101.
14-23 March 1979	Einstein Centenary Symposium, Jerusalem, Israel. Contact: Israel Academy of Sciences and Humanities, P.O. Box 4040, Jerusalem, Israel.
19-21 March 1979	Symposium on the History of Agricultural Science and Technology. Contact: Homer E. Socolofsky, Department of History, Kansas State University, Eisenhower Hall, Manhattan, KS 66056.
24-25 March 1979	Second Annual Greater Boston Undergraduate Conference on Bioethics, Boston College, Chestnut Hill, MA. Contact: Mendel Club, Higgins 611, Boston College, Chestnut Hill, MA 02167.
26-27 March 1979	Workshop on Science, Technology, and Society: Instructional Aids, University Park, PA. Contact: Philip H. Becker, 123 Steidle Building, The Pennsylvania State University, University Park, PA 16802.
6-7 April 1979	6th Annual Meeting of the Joint Atlantic Seminar in the History of the Physical Sciences, University of Pennsylvania. Contact: Profs. Robert E. Kohler or Jeffrey L. Sturchio, Department of History and Sociology of Science, E.F. Smith Hall - D6, University of Pennsylvania, 215 South 34th St., Philadelphia, PA 19104.
7-8 April 1979	Second Annual Meeting, Southern Association for History of the Sciences and Technology, University of Kentucky, Lexington. Contact: Bruce Eastwood, Department of History, Office Tower 1757, University of Kentucky, Lexington, KY 40506.
19-21 April 1979	Conference on the Humanities in a Computerized World, SUNY-Albany, New York. Contact: M.E. Grenander, The Institute for Humanistic Studies, State University of New York at Albany, Albany, NY 12222.
20-21 April 1979	Thirteenth Conference on Value Inquiry; topic: "The Life Sciences and Human Values." Contact: Directors, 13th Conference on Value Inquiry, Department of Philosophy, SUNY-Geneseo, Geneseo, NY 14454.

18-20 May 1979	Philosophy and Economics Conference, Michigan State University, East Lansing, MI 48824. Contact: Bruce Miller or Richard Peterson, Department of Philosophy, Michigan State University, East Lansing, MI 48824.
4-8 June 1979	Second IFIP Conference on Human Choice and Computers, Vienna, Austria. Contact: IFIP Conference on Human Choice and Computers, Austrian Organizing Committee (Fred Margolies), P.O. Box 179, A-1013 Vienna, Austria.
20-31 August 1979	United Nations Conference on Science and Technology for Development, Vienna, Austria.
22-29 August 1979	International Union of History and Philosophy of Science Sixth International Congress of Logic, Methodology and Philosophy of Science, Hannover, Federal Republic of Germany.
14-17 September 1979	Royal Institute of Philosophy Conference on Law and Philosophy, University of Lancaster, Lancaster, England. Contact: M.A. Stewart, Department of Philosophy, The University, Lancaster LA1 4YT, England.
17-20 October 1979	Annual Meeting of the Society for the History of Technology, Newark, NJ. Chairperson: Reese V. Jenkins, Rutgers University, 1 Richardson St., New Brunswick, NJ 08903.
29-31 October 1979	Annual Conference of the Association for Computing Machinery, Plaza Hotel, Detroit, MI. Theme: "Advances of the 70's--Challenges of the 80's." Program Chairman: James L. Elshoff, Computer Science Department, General Motors Research Laboratories, Warren, MI 48090.
2-4 November 1979	Third Annual Meeting, Society for the Social Studies of Science, Washington, DC. Contact: Albert Teich, Graduate Program in Science, Technology and Public Policy, Georgetown University, Washington, DC 20052.
December 1979	Annual Meeting of the History of Science Society in conjunction with the American Historical Association, New York City. Program committee chairman: Arthur Donovan, Department of History, West Virginia University, Morgantown, WV 26506.
22-26 September 1980	Third International Congress on the History of Oceanography, Woods Hole, MA. Chairman: Daniel Merriman, Professor Emeritus of Biology (Yale University), 298 Sperry Road, Bethany, CT 06525.

THE RECOMBINANT DNA CONTROVERSY: ARCHIVAL AND ORAL HISTORY RESOURCES

Charles Weiner
Program in Science, Technology and Society
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

In the four years since the Asilomar Conference, the controversy over recombinant DNA research has spawned sixteen congressional bills, a scattering of state and local legislation, and volumes of congressional hearings and reports. All of this has been paralleled by a steady stream of articles in the scientific and popular press, and extensive coverage on radio and television. To date, thirteen books on the subject have been published or are in press. In addition to this published record, a rich collection of archival and oral history materials now also documents, in much detail, the roles of individuals and institutions in the development of rDNA research and the concern over its safety and applications. These source materials are part of the Recombinant DNA History Collection available for research use at the M.I.T. Institute Archives.

The collection is the result of a unique experiment in documenting the contemporary history of science. In Spring 1975, shortly after the Asilomar Conference, the M.I.T. Oral History Program began active collection and cataloguing of documents on the rDNA controversy. As the issues unfolded, the M.I.T. project monitored and recorded hearings and meetings on the national and local levels, collected letters, minutes, notes, memoranda and reports of institutions and individuals; and conducted and transcribed taped oral history interviews with participants in the United States and Europe. The initial archive deposit was made in October 1976, and the amount catalogued and accessible for research has increased steadily ever since. At present, transcripts of interviews with more than 80 individuals (about 6,000 typed pages) are catalogued and available for study, along with about 12 linear feet (36,000 pages) of written materials comprised of more than 1,800 letters, 1,800 documents, and 1,200 press clippings. Additional written materials and transcripts of interviews with about 40 more individuals will be available for research in the coming months. The audio and video tape documentation presently covers 95 events.

The project staff obtained most of these materials directly from the participants. The interviews were held with scientists involved in recombinant DNA research, policy-makers and advisors concerned with regulations and legislation, critics of the research and of efforts to regulate it, citizens who served on local boards inquiring into the safety of the research, industrial researchers in the field, and journalists who covered the events. They were asked to provide detailed first-person testimony about their own involvement in key events and processes. Together, the letters, documents and interviews shed light on the origins of the research and the concern among scientists about its safety, the Asilomar Conferences on potential biohazards in 1973 and 1975, the formulation of safety guidelines in the United States and in European nations, the rise of public interest and participation, and efforts to draft and influence regulatory legislation. Because the project followed the issues as they developed, the collection frequently documents changes in scientists' perceptions of the possible hazards of recombinant DNA research and of their responses to increasing public and governmental concern.

Use of the Collection

More than 80 individuals from institutions throughout the United States have already used the materials currently available for research for purposes that range from undergraduate course papers and graduate theses, to books and popular articles, including one that received the 1977 AAAS-Westinghouse Science Writing Award. Among the topics that have been studied are: ethical concerns of scientists; history of molecular biology; citizen participation in science; legal issues in scientific research; national patterns in regulation of research; problems in public understanding of science; emergence of new research fields; the role of critics in the scientific community; the sociology of scientific communication; risk assessment procedures; and individual biographies of scientists. Materials in the collection have also been used for curriculum development and for video and film projects.

The depth and range of the collection is considerable. A few examples follow. The collection has extensive documentation of the 1975 Asilomar Conference and the events leading up to it, obtained shortly after the conference, and including interviews with 36 participants. The development of U.S. guidelines by the NIH Recombinant DNA Molecule Program Advisory Committee and the NIH Director's Advisory Committee is covered through extensive written documentation, tapes of meetings, and interviews with 15 individuals. The collection also provides unique perspectives on the progress of congressional bills to regulate rDNA research, with particular emphasis on the roles of staff advisors and of lobbyists for universities, scientific organizations and environmental groups. Local responses to the issue are documented through press clippings, reports, tapes of meetings and interviews with scientists, politicians, and members of citizen or university review boards in the communities of Cambridge (Massachusetts), Ann Arbor (Michigan), and San Diego (California). Nineteen interviews have been conducted thus far with European scientists, covering their research in the field, the role of the European Molecular Biology Organization, and the development of guidelines in several countries.

To make the most effective use of the collection, researchers should, of course, always first consult the extensive published record of the recombinant DNA controversy. Specific inquiries about the contents and use of the collection should then be made to Helen Slotkin, Institute Archivist, M.I.T. Institute Archives and Special Collections, Bldg. 14N-118, Cambridge, MA 02139. A detailed inventory at the Archives guides the user to the appropriate catalog section. For example, if the subject of interest is local community response, the inventory and catalog will lead the user to materials listed under specific communities. If the specific interest is San Diego, then the listings will show minutes, reports and tapes of meetings of the City Council and the DNA Study Committee of the Quality of Life Board, minutes of the University of California-San Diego biohazards committee, press clippings, and transcripts of interviews with eight individuals involved in the local response to the issue. In this case, as in all others, the oral history interviews are best used in conjunction with the written materials.

Future Directions

The Recombinant DNA History Project was initiated in Spring 1975 by Charles Weiner in collaboration with Rae Goodell. Initial support from the M.I.T. Oral History Program was soon supplemented by a grant from the Ethics and Values in Science and Technology Program of the National Science Foundation, and thereafter until 31 January 1979, by joint grants from EVIST and from the National Endowment for the Humanities Program of Science, Technology and Human Values.

During the past several years, research using recombinant DNA techniques has grown rapidly. Further growth will be stimulated by initial successes in several fields of biology and in industrial applications. The National Institutes of Health revised guidelines, all effective in January 1979, are generally less restrictive than the previous guidelines and this is likely also to encourage further research. Similar developments are underway in Europe, and national differences in approaches to guidelines and in the restraints imposed on researchers could have an effect on international competition and on the mobility of researchers. Although no legislation was passed in the last session of Congress, several bills are still alive and further congressional action on the subject is anticipated in 1979. Public interest in the issue is increasing in several European countries, as national regulations are developed and applied to an increasing number of laboratories newly involved in recombinant DNA research. Although the active grant period has ended for the project, the M.I.T. Oral History Program will attempt, wherever possible, to supplement the collection with source materials documenting these events for the historical record.

FURTHER RESOURCES

The staff of the Recombinant DNA History Project has produced a 30-minute, 1/2-inch videotape of the June 1976 Cambridge (Massachusetts) City Council Hearing. The tape consists of excerpts from the full archival videotapes and should be used together with background materials on the controversy. Persons interested in obtaining a copy, on a short-term loan basis, should write directly to: Charles Weiner, Professor of History of Science and Technology, Room 20D-224, Massachusetts Institute of Technology, Cambridge, MA 02139.

GUIDE TO FUNDING FOR SCIENCE, TECHNOLOGY, AND VALUES PROJECTS: NEH AND NSF

Compiled by
Vivien B. Shelanski

The National Endowment for the Humanities (NEH) and the National Science Foundation (NSF) are the principal public agencies offering support for research and education projects in the area of science/technology/human values. The following guide is provided to acquaint readers with the opportunities in each agency and with the differences between the program structures in the two organizations.

At the NSF, research support programs are organized according to discipline or problem-area. Those particular programs that may fund STV projects are: Ethics and Values in Science and Technology (EVIST); Science for Citizens (SFC); and Public Understanding of Science (PUOS). Together these programs comprise the Office for Science and Society, situated within NSF's Directorate for Science Education. Limited support for STV projects is also offered by the History and Philosophy of Science Program, within the Directorate for Biological, Behavioral, and Social Sciences.

By contrast, programs at the NEH are organized according to the type of award rather than discipline or subject area and, therefore, support for STV projects is available from each of the Endowment's Divisions: Research Grants, Fellowships, Education Programs, and Public Programs. The NEH has also identified the relationship between science, technology and human values as an area of special interest. Efforts in this area are coordinated by the Program of Science, Technology and Human Values. Although proposals should normally be submitted through one of the established Divisional Programs (described below), if the project does not readily fall within the scope of an NEH division, then a proposal may be submitted directly to the STHV Program Office.

As a result of these organizational patterns, at the NSF a proposal for research in STV competes with other proposals in the same general subject area. At the NEH, however, an STV proposal competes in a division with all other requests for that category of award (research grant, fellowship, etc.), regardless of the particular discipline or subject matter involved.

1. Where To Apply

If the subject of inquiry falls primarily within the natural sciences, social sciences, or technology, or if the methodology to be used is primarily scientific, the proposal should be directed to the NSF. If the subject of inquiry is primarily humanistic and if the methodology is primarily philosophical or historical, the proposal would be appropriate for the Endowment.

Projects involving both the sciences and the humanities, in terms of subject matter, methodology, and personnel, may be considered by both agencies for joint funding. Inquiries about the appropriateness of concurrent submission should be directed to:

Program of Science, Technology, and Human Values
Office of Planning and Analysis
Mail Stop 103
National Endowment for the Humanities
Washington, DC 20506

and

EVIST Program
Office of Science and Society
National Science Foundation
Washington, DC 20550

2. Overview of NEH Divisions and Types of Awards

2.1 Division of Research Grants

Projects sponsored by this division usually involve long-range collaborative efforts between several scholars and employing other individuals at the professional, assistant, and clerical levels. Address inquiries to: Division of Research Grants, Mail Stop 350, National Endowment for the Humanities, 806 Fifteenth St., N.W., Washington, DC 20506.

2.2 Division of Fellowships

NEH fellowships are intended to support individual scholars for periods ranging from six to twelve months and are offered in three types:

Category A fellowships are awarded for independent study and research by scholars, teachers, and others whose work "seems likely to lead to significant contributions in humanistic thought and knowledge."

Category B is only for persons who primarily teach undergraduates; these awards promote a year of full-time study and research.

Category C fellowships enable teachers in undergraduate and two-year colleges to participate in designated seminar programs or to pursue independent related research. The largest efforts of this type are the summer seminars and summer stipends for college teachers. "Fellowships and Stipends for the Professions" awards allow persons in professions outside teaching an opportunity to study "historical, philosophical, social, and cultural dimensions of their professional interests."

Address inquiries to Division of Fellowships, Mail Stop 101, National Endowment for the Humanities, 806 Fifteenth Street, N.W., Washington, DC 20506.

2.3 Division of Education Programs

Through its Institutional Grants Program, this division offers: Consultant Grants (enabling institutions to obtain assistance in developing and evaluating humanities curricula); Pilot Grants (to enable institutions to test a new humanities course sequence); and Development Grants (to support the introduction of a new program in the humanities into the ongoing curriculum, or extensive revisions in existing programs).

The Elementary and Secondary Education Program supports demonstration projects in humanities education. The Cultural Institutions Program assists libraries and museums in providing formal and systematic educational programs for students and the general public.

Address inquiries to: Director of Education Programs, Mail Stop 202, National Endowment for the Humanities, 806 Fifteenth St., N.W., Washington, DC 20506.

2.4 Division of Public Programs

This program division offers support to museums, historical organizations, libraries, radio and television stations, and film or video production centers for projects that draw substantially upon the resources of the humanities and are directed primarily to the adult, non-student population. Address inquiries to: Division of Public Programs, Mail Stop 400, National Endowment for the Humanities, 806 Fifteenth St., N.W., Washington, DC 20506.

3. Overview of NSF Programs

3.1 Ethics and Values in Science and Technology

The NSF EVIST Program supports research, conferences and workshops on:

a) Issues in the education and professional conduct of scientists and engineers;
b) Issues of obligations and constraints associated with institutions and organizations;
c) Issues associated with new developments in science and technology;
d) Effects of changing ethical and social values and expectations upon scientific priorities and upon the conduct of scientific and technological activities;
e) Ethical issues and value assumptions in decisionmaking processes involving science and technology.

Address inquiries to: EVIST Program, Office of Science and Society, National Science Foundation, Washington, DC 20550.

3.2 Science for Citizens

The Science for Citizens (SFC) Program encourages individuals and organizations to develop scientific and technical assistance projects to help citizens and citizen groups deal effectively with public policy issues that may have a direct impact on their lives.

Public Service Science Residencies enable experienced scientists and engineers, and science and engineering students to provide community groups such as citizens' organizations, trade unions, and state and local government offices, with scientific and technical information. Appropriate projects for this program include: development of handbooks, exhibits, radio and television programs, workshops, or other informal science education activities for adults; data analysis and dissemination; and small-scale research on specific problems associated with current issues.

SFC Forums, Conferences, and Workshops increase opportunities for communication of the objective scientific information necessary for informed discussion of local policy issues involving science and technology.

SFC Planning Studies support the development of viable plans for stable, locally-based structures or processes (such as public service science centers or networks) that can provide timely and intelligible scientific and technical assistance to communities. Proposals for Forums, Conferences, and Workshops, and for Planning Studies may be submitted by citizen groups, educational institutions, professional or trade associations or trade unions, units of state and local government, and other nonprofit organizations. Address inquiries to: Science for Citizens Program, Office of Science and Society, National Science Foundation, Washington, DC 20550.

3.3 Public Understanding of Science

Activities eligible for support under the PUOS Program include:

1) Projects to improve the understanding among the general public of the processes and activities of science and technology, especially with respect to major issues of personal and public concern. Such projects--which must be addressed to the general public or to important segments of the public--may include: radio and television programs; newspaper and magazine reporting and other written presentations; museum and science center exhibits and activities; dramatic and film presentations; or lectures, workshops and popular science activities.

2) Projects to increase the scope, level and quantity of communication between scientists and nonscientists. For example, projects designed to: increase the effective participation of scientists and engineers in meeting public needs for information; improve the scientific background and skills of newspaper, radio and television editors, reporters and commentators; improve the skills of professional science writers; improve the ability of existing channels of communication to interpret and distribute scientific information to the public; or develop innovative mechanisms to communicate more effectively with the public.

3) Studies of the communication of scientific information to the public, such as: studies of the nature and interests of different public audiences; or evaluation of the costs and benefits and the comparative impact of alternative channels and techniques of public

communication. Address inquiries to: Public Understanding of Science Program, National Science Foundation, Washington, DC 20550.

3.4 History and Philosophy of Science Program

Eligible projects include research into the growth of the biological, engineering, mathematical, physical, and social sciences; the development of scientific organizations, social institutions, and intellectual and other movements significant for understanding the growth of science and technology; various factors responsible for the development of science and technology; relationships between scientific and technological developments, particularly in the recent era; the relationship of scientific inquiry to values; and pertinent philosophical analyses of the relation of science to other human activities. Address inquiries to: History and Philosophy of Science Program, Directorate for Biological, Behavioral, and Social Sciences, National Science Foundation, Washington, DC 20550.

4. Fiscal Year 1978 Awards

The following lists of awards are provided as examples of STS or STV (or related) projects or research that have been funded by the NSF and NEH for FY1979. These grants are not, of course, all that have been awarded by these agencies.

4.1 NSF Ethics and Values in Science and Technology (EVIST) Program

"Ethics and Values in Agricultural Research: A Case Study" - William Friedland, University of California at Santa Cruz, CA.

"Ethical Components of Peer Review in Medicine" - Eliot Freidson, Center for Policy Research, Inc., New York, NY.

"Social Values and Clinical Medicine: An Interdisciplinary Conference" - Eric J. Cassell, Cornell University College of Medicine, New York, NY.

"Ethical Problems in Social Science Research with Human Subjects" - Tom L. Beauchamp, Georgetown University, Washington, DC.

"Social Impacts of the Recombinant DNA Controversy" [Supplementary Grant] - Charles Weiner, Massachusetts Institute of Technology, Cambridge, MA.

"Value Issues in Research on the Biological Effects of Microwave Radiation: A Case Study" - Nicholas H. Steneck, University of Michigan, Ann Arbor, MI.

"Ethical Issues in the Delivery of Health Care Within Detention and Correctional Institutions" - Nancy N. Dubler, Montefiore Hospital and Medical Center, Bronx, NY.

"Workshops on Ethical Problems in the Production, Use and Regulation of Toxic Substances" - Albert J. Fritsch, Technical Information Project, Washington, DC.

"Ethical Considerations in the Natural Sciences: A Workshop for College Science Teachers" - Morton Tavel, Vassar College, Poughkeepsie, NY.

"Ethical Problems of Fieldwork in Anthropology and Sociology" - Murray L. Wax, Washington University, St. Louis, MO.

4.2 Joint NSF-NEH Awards in the Area of Science, Technology, and Values

All awards were made jointly by the NEH Program of Science, Technology and Human Values and the NSF Ethics and Values in Science and Technology

Program, unless otherwise noted.

"Value Issues in the Control of Technology-Related Damage" - Jane C. Kronick, Bryn Mawr College, Bryn Mawr, PA.

"Values and Value Changes in the Formulation of the Pittsburgh Air Polution Control Statutes" - Joel Tarr, Carnegie-Mellon University, Pittsburgh, PA.

"Bibliography of the Philosophy of Technology" - Carl Mitcham, St. Catharine College, KY. [Joint funding by NEH Program of Science, Technology and Human Values and NSF History and Philosophy of Science Program.]

"International Conference on Ethical and Value Issues in the Social Assessment of Science" - Everett Mendelsohn, Harvard University, Cambridge, MA.

"Bibliography of Engineering Ethics" - Robert F. Ladenson, Illinois Institute of Technology, Chicago, IL.

"Workshops on Ethical Issues in Engineering" - Vivian Weil, Illinois Institute of Technology, Chicaco, IL.

"Case Studies of Value Issues in the Application of Technology in Law Enforcement" - Raymond G. Hunt, Institute for the Study of Contemporary Social Problems, Seattle, WA.

"Values and the Public Works Practitioner" - Daniel L. Babcock, University of Missouri, Rolla, MO.

"Ethical Issues in Biomedical Decision Making: Four Case Studies" - Diana B. Dutton and John P. Bunker, Stanford University, Stanford, CA.

"Value Issues in the Controversy over Recombinant DNA Research" - Sheldon Krimsky, Tufts University, Medford, MA.

4.3 National Endowment for the Humanities

Program of Science, Technology and Human Values

"Elements and Principles of Closure in Ethical and Scientific Disputes" - Institute of Society, Ethics and the Life Sciences, Hastings-on-Hudson, NY.

Division of Fellowships

Research Grants:

"Resources for the History of Medical Physics," to document nuclear medicine at University of California Radiation Laboratory, 1935 to 1960, - James D. Hart, University of California, Berkeley, CA.

"Medical Behavior at Auschwitz" - R. Lifton, Yale University, New Haven, CT.

Fellowships:

"Radio Technology in the Vacuum Tube Era: Invention, Innovation, and Social Policy" - Hugh G.J. Aitkin (Economics), Amherst College, MA.

"Public Health and Political Economy: French investigations, 1815-1848" - William Coleman (History of Science), Johns Hopkins University, Baltimore MD.

"Psychoprophylaxis in Obstetrics" - John D. Bell (History), University of Maryland, Baltimore, MD.

"Microbiology, Public Health, and the Development of Urban Civil Engineering in Nineteenth-Century Paris" - Charles J. Haug (History), Mississippi State University.

"Locke's Theories of Scientific Knowledge and Natural Kinds" - Ruth M. Mattern (Philosophy), University of Pennsylvania, Philadelphia, PA.

"Science, Science Fiction and Modes of Change," - Edward Gubar (English) Indiana-Purdue University at Indianapolis, IN.

Fellowships for the Professions - Seminars for Medical Practitioners:

"The Quest for Professional Ethics in American Medicine" - Chester R. Burns (Medical Humanities), University of Texas Medical Branch, Galveston, TX.

"Ethics and Health Care" - James F. Childress, Kennedy Institute, Georgetown University, Washington, DC.

"Individual Rights and the Public Good in Medical Treatment" - John Lachs (Philosophy), Vanderbilt University, Nashville, TN.

Fellowships for the Professions - Seminars for Medical and Health-Care Teachers:

"The Philosophical Roots of Ethics" - H. Tristram Englehardt, Jr., Kennedy Institute of Ethics, Georgetown University, Washington, DC.

"The Role of the Medical Profession in American Society: Historical Evolution of Issues in Health Care" - Gert H. Brieger (History of Health Sciences), University of California, San Francisco, CA.

"The Human and Institutional Setting for Medical Ethics" - William F. May (Religious Studies), Indiana University, Bloomington, IN.

"Ethics and Health Care" - James F. Childress (Religious Studies), University of Virginia, Charlottesville, VA.

Fellowships for the Professions - Seminars for Journalists:

"Technology and the Democratization of American Society" - Melvin Kranzberg (History of Technology), Georgia Institute of Technology, Atlanta, GA.

Summer Seminars for College Teachers:

"Concepts of Scientific Explanation" - Peter Achinstein (Philosophy), Johns Hopkins University, Baltimore, MD.

"Technology, Society and Values in Twentieth-Century America" - John G. Burke (History), University of California, Los Angeles, CA.

"The Functions of Discourse in Science and Literature" - Fred E. Carlisle (English), Michigan State University, East Lansing, MI.

"On the Importance of History to the Philosophy of Science" - Ian Hacking (Philosophy), Stanford University, Stanford, CA.

"Liberty, Equality and Fidelity in Bioethics" - David H. Smith (Religious Studies), Indiana University, Bloomington, IN.

Division of Education

Biomedical Education Programs:

State University of New York at Stony Brook, To develop coordinated curriculum linking humanities studies to pre-professional and professional health care education, Peter C. Williams (Social Sciences and Humanities, Health Sciences Center).

University of Tennessee, Memphis/Knoxville, To develop and implement a comprehensive clinical humanities residency for medical educators, David [illegible] Thomasma and Glenn Graber.

Georgetown University, Washington, DC, To develop a new program in health and humanities, to bring health-related humanities to those in training for health professions, Warren T. Reich.

General Education Programs:

Carnegie Museum of Natural History, Carnegie Institute, Pittsburgh, PA, "Man's evolutionary and cultural history," To present programs and classes on human biological and cultural history, emphasizing relations to environmental problems.

Lakeland College, Sheboygan, WI, To test a core multidisciplinary course, for bringing humanities and sciences to bear on contemporary issues (Reinhardt Ulrich).

University of Missouri, Rolla, MO, To develop a freshman course, which will be an alternative to three separate introductory courses, in Civil Engineering, English, and History (Larry Vonalt).

Northeastern University, Boston, MA, To develop humanities-science courses for students in professional programs, particularly allied health, and engineering (Clay McShane).

Shedd Aquarium, Chicago, IL, To develop materials, and to design tours, for fifth and sixth grade levels, to increase awareness of values related to marine environmental problems (Beverly Serrell).

South Georgia College, Douglas, GA, To develop and evaluate a course on American culture and technology (John W. Fink).

Ohio University, Athens, OH, To develop and evaluate a course on interfacing of philosophy and technology (Donald M. Borchert).

Lewis and Clark College, Portland, OR, To develop and evaluate a course to survey technology in Western culture, and focus on technology and values in the American experience (John F. Callahan).

Vanderbilt University, Nashville, TN, To develop and evaluate a course in ethics and public policy, with particular reference to the role of science in public policy (George J. Graham, Jr.).

Michigan State University, East Lansing, MI, Pilot grant to prepare for introduction of six interdisciplinary courses on medicine and human values.

Case Western Reserve University, Cleveland, OH, To introduce knowledge of gerontology to humanities instructors, so that perspectives on aging can be incorporated in various courses (David D. Van Tassel).

Lehigh University, Bethlehem, PA, To continue publication of the Curriculum Development Newsletter of the Humanities Perspectives on Technology (HPT) Program (Steven Goldman).

Xavier University of Louisiana, New Orleans, LA, To introduce a course in philosophy of science (Martha Pelaez).

Quinnipiac College, Hamden, CT, To develop a humanities concentration for students in the School of Business and the School of Allied Health and Natural Sciences (Robert Sandels).

Humanities Consultant Grant - Science and Engineering

Montana College of Mineral Science and Technology, Butte, MT.

Humanities Consultant Grants - Health Professions

Thomas Jefferson University, College of Allied Health Sciences, Philadelphia, PA.

New York University Medical Center, New York, NY.

The College of Medicine and Dentistry of New Jersey, Newark, NJ.

College of St. Scholastica, Duluth, MN.

Division of Public Programs

Bowling Green State University, OH, "Ethics and the Environment," To research and develop a pilot script, towards a television series highlighting philosophical aspects of environmental issues (Donald Scherer and Thomas Attig, Department of Philosophy).

American Association of Community and Junior Colleges, To plan toward community forums on energy use and the humanities.

Institute for Advanced Study, Princeton, NJ, To plan toward public programs for the Einstein Centennial.

The Fairbanks Museum and Planetarium, St. Johnsbury, VT, To plan toward adoption of new value-oriented techniques for science exhibits (William G. Brown).

Institute for Advanced Study, Princeton, NJ, In connection with activities of the Einstein Centennial Celebration, to encourage broader understanding of both scientific and humanistic values and their interrelationships (John Hunt).

Biomedical:

KCTS/Channel 9, University of Washington, Seattle, WA, To produce two pilot programs for a 6-part bioethics series (Sandra Walker).

WGBH Educational Foundation, Boston, MA, For research and development work toward a 13-part television series on the social history of American medicine, 1721-1921 (Josephine Gladstone).

Zoological Society of Philadelphia, PA, Exhibit/presentation on "Man and the Natural World" (John M. Delaini).

Special Projects

University of California, San Diego, CA, To support Fall 1979 and Spring 1980 courses related to science, technology and medicine, under the Courses By Newspaper project (George A. Colburn).

Youth Programs

Laura Punnett, Northampton, MA, To study "Women-Controlled Medicine: Theory and Practice in Nineteenth Century Boston."

NEH SUMMER SEMINARS FOR COLLEGE TEACHERS IN 1979

National Endowment for the Humanities Summer Seminars for College teachers are designed to allow teachers in undergraduate and two-year colleges to work for two months with distinguished scholars in their fields. Some 1979 seminars of interest to STHV readers are:

"Liberty, Equality, and Fidelity in Bioethics," 18 June - 10 August 1979, David H. Smith (Department of Religious Studies, Indiana University, Bloomington, IN 47401).

"The Unity of Learning in the Later Middle Ages," 25 June - 17 August 1979, John E. Murdoch (Department of the History of Science, Science Center 235, Harvard University, Cambridge, MA 02138).

"The Social History of Modern Science," 25 June - 17 August 1979, Everett I. Mendelsohn (Department of the History of Science, Science Center 235, Harvard University, Cambridge, MA 02138).

"Physicists in Historical Context," 18 June - 10 August 1979, Martin J. Klein (c/o Yale Summer Programs Office, 320 W.L. Harkness Hall, Yale Station, New Haven, CT 06520).

"The Importance of History to the Philosophy of Science," 18 June - 10 August 1979, Ian Hacking (Department of Philosophy, Stanford University, Stanford, CA 94305).

"Professions: Servants or Masters?" 11 June - 3 August 1979, Eliot Freidson (Rm. 325, 19 University Place, Department of Sociology, New York University, New York, NY 10003).

Prospective seminar applicants should request details on seminar requirements and assignments directly from seminar directors. Participants receive a $2500 stipend for travel expenses to and from the seminar, books and other research expenses, and living expenses for the entire tenure period. A brochure describing the seminars and including application blanks may be requested from the Div. of Fellowships, National Endowment for the Humanities, 806 15th St., N.W., Washington, DC 20506. Deadline is 1 April 1979.

A CONCISE SELECTED BIBLIOGRAPHY ON PROFESSIONAL ETHICS

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The defining characteristic of a professional is the possession of a unique authority derived from specialized knowledge and skills that are obtained through experience and training. This authority endows the professional with power. However, the essence of professional power is not the ability to force another to do one's will; rather, it is the advantage gained by having title to knowledge of which others are both ignorant and in need. Given the public's enforced reliance on the services only a professional can provide, how, then, should this special power be used?

Discussion of "Professional Ethics" includes critical examination of the ethical problems created by or surrounding the exercise of professional skills and knowledge. For example, what are the appropriate roles and moral responsibilities of the professional? How can these standards be more successfully incorporated into practice? Do professional codes of ethics adequately define the limits of this authority?

The difficulties associated with defining and assessing professional responsibilities are made apparent when we note that most professionals--particularly scientists and engineers--work within the context of large private or governmental organizations. Systematic structuring of the activities of professionals by corporate and governmental organizations raises many interesting and complex issues. How does practicing within the context of a large organization affect and influence the individual professional's perceptions of, and his or her commitment to, social and ethical responsibilities? What is the exact relationship between the responsibilities accepted by the individual professional and the collective, shared responsibilities of all professionals in that field? What responsibilities (legal and moral) does the organization actually assume? What are the duties of the organization to respect an employee's judgments and ideals? How should conflicts between the responsibilities dictated by organizational goals, and the individual's social and ethical responsibilities be resolved? In short, how may we interpret "professional responsibility" in the context of complex organizations?

In addition to such general questions, the exercise of professional authority raises ethical problems particular to each profession. Some of these issues are discussed and evaluated in books and articles listed in this bibliography. The bibliography also includes materials that focus on the conceptual, historical, and sociological foundations of the professions. I have also included some references describing actual cases of questionable practice by professionals. Finally, this bibliography is not intended to be comprehensive, but rather is designed to serve as a brief introduction to the kinds of issues specific to the field of professional ethics.

A. GENERAL WORKS ON THE PROFESSIONS AND PROFESSIONAL ETHICS

Austin, Robert W. "Codes of Conduct for Executives." 39 Harvard Business Review (September-October 1961). Reviews arguments necessitating a code of conduct, analyzes sample cases, and proposes guidelines for a "sound" code.

Baird, Charles W. Advertising by Professionals. (Ottawa, Canada: Green Hill Publishers, 1978). Useful analysis of the social and ethical problems raised when professionals advertise.

Carr-Saunders, A.M., and P.A. Wilson. The Professions. (Oxford, England: Clarendon Press, 1928). The professions and the problems confronting them, including ethical problems.

Clapp, Jane, ed. Professional Ethics and Insignia. (Metuchen, NJ: The Scarecrow Press, 1974). Lists 205 professional organizations from accountants to zoologists with each organization's code of ethics and statement of public duties.

Cohen, Marshall, Thomas Nagel, and Thomas Scanlon, eds. Equality and Preferential Treatment. (Princeton, NJ: Princeton University Press, 1977). Philosophical analysis of the problems created by affirmative action programs.

Durkheim, Emile. Professional Ethics and Civic Morals. (London: Routledge and Kegan Paul, 1957). Stimulating treatise on methods for raising standards of morality in professional practice.

Elliot, Philip. The Sociology of the Professions. (New York: Herder & Herder, 1972). This book attempts to show how a sociological examination of the professions can lead to a more general analysis of change in the social structure.

French, Peter A., ed. Individual and Collective Responsibility. (Cambridge, MA: Schenkman Publishing Co., 1972). Philosophical analysis of collective and individual responsibility in the My Lai massacre.

Gitlin, Todd. "The Televised Professional." Social Policy (November-December 1977). Examines images of the professional and his clients as depicted on television, and the implications of those images for actual practice.

Gordon, Bruce F., and Ian C. Ross. "Professionals and the Corporation." Research Management 5 (November 1962): 493-505. Discusses the role of the professional in the corporation, characteristics of professional status, supervision of professionals, and the problems of categorizing professional activities.

I extend my appreciation to Patrick Munday for his assistance in annotating some of the articles included in this bibliography -- A.F.

Gothie, Daniel T., ed. *A Selected Bibliography of Applied Ethics in the Professions 1950-1970*. (Charlottesville, VA: University Press of Virginia, 1973). Valuable sourcebook containing references on ethics in the major professions.

Hughes, Everett C. "The Professions in Society." *The Canadian Journal of Economics and Political Science* (February 1960). Professionalization, professional status, and the paradoxes of professional autonomy are examined.

Karpatkin, Rhoda H. "Advertising Professional Services." *Social Policy* (November-December 1977). Discussion of advertising in the professions and the effects on the consumer.

Kurtz, Paul, ed. *Ethics in America*. (Buffalo, NY: Humanist Magazine, 1977). Noted practitioners discuss the ethical problems of their respective fields.

Lieberman, Jethro K. *The Tyranny of Experts*. (New York: Walker and Company, 1970). Critical analysis of the use of authority and its implications for society.

Lynn, Kenneth S. *The Professions in America*. (Boston, MA: The Beacon Press, 1963). A *Daedalus* symposium on the major professions; each article provides a useful overview of each profession.

Moore, Wilbert E. *The Professions: Roles and Rules*. (New York: Russell Sage Foundation, 1970). Sociological analysis of the professions and the regulation of professional practice.

Nader, Ralph, Peter Petkas and Kate Blackwell. *Whistle Blowing*. (New York: Grossman Publishers, 1972). Contains case studies and analyses of the social and ethical problems facing those who work in organizations.

Page, B.B. "Who Owns the Professions." *Hastings Center Report* (October 1975). Critique of the special economic privileges of the professions.

Parsons, Talcott. "The Professions and Social Structure." 17 *Social Forces* (May 1939).

Peters, Charles, and Taylor Branch. *Blowing the Whistle.* (New York: Praeger Publishers, Inc., 1972). Cases of whistle blowing are described and analyzed.

Prandy, Kenneth. *Professional Employees: A Study of Scientists and Engineers*. (London: Faber and Faber Ltd., 1965). Investigates the problems of employed professionals, particularly their acceptance of the employer's ideology.

Reagor, Simone. "The Professionalization of the Humanities." *Chronicle of Higher Education* (25 April 1977). Problems of contemporary academics.

Ruegg, Fred T. "Ethical Responsibilities of Management." 37 *Advanced Management Journal* (February 1962): 5-10. If government regulation is to be avoided, then individuals must assume the social and ethical responsibilities of their professions.

Singer, Marcus G., ed. *Morals and Values: Readings in Theoretical and Practical Ethics*. (New York: Charles Scribner's Sons, 1977). A distinguishing feature of this anthology is its emphasis on the application of theory to practical moral problems; contains many classic sources.

"Special Report: The Troubled Professions." *Business Week* (August 1976): 126-38. Essays survey the major professions and the special problems they each face, their changing roles, and the need for public oversight.

Taeusch, Carl F. *Professional and Business Ethics*. (New York: Henry Holt & Co., 1926). The ethical responsibilities of the major professions as seen from a philosophical perspective.

"Watergating on Main Street." *Saturday Review* (November 1975). Special issue containing articles by Max Lerner, Tom Braden, I.R. Kaufman, *et al*., on the major professions.

Yarmolinsky, Adam. "What Future for the Professions in American Society?" *Daedalus* (Winter 1978). An examination of current social trends that challenge the status of professionals in America.

B. PROFESSIONAL ETHICS FOR SCIENTIFIC RESEARCHERS

Burke, John G., ed. *The New Technology and Human Values*. (Belmont, CA: Wadsworth, 1966). A book of readings exploring the effects of scientifically-based technology on human values.

Cooper, Joseph D., and Herbert L. Ley. *Ethical Safeguards in Research on Humans*. (Washington, DC: The Interdisciplinary Communication Associates, Inc., 1976). Focuses on the problem of human experimentation with an emphasis on responsibilities of the individual and society in this context.

Crawford, Alex H. "Chemistry and the Quality of Life." *Technology and Society* (August 1974). Examines the economic, political and environmental impacts of developments in the field of chemistry.

Haybittle, John. "Ethics for Scientists." 20 *Bulletin of the Atomic Scientists* (May 1964): 23-4. Examines the question of the scientist's responsibility for the uses of scientific knowledge and suggests that research designs include consideration of human values.

Hook, Sidney, Paul Kurtz, and Muro Todorovich, eds. *The Ethics of Teaching and Scientific Research*. (Buffalo, NY: Prometheus Books, 1977). Articles by scholars on the special ethical responsibilities and the associated issues in teaching and research in various scientific fields.

Merton, Robert K. The Sociology of Science. (Chicago, IL: University of Chicago Press, 1973). Collection of articles by Merton and others examining the sociological foundations of contemporary science and its practitioners.

Miller, Doris K. "Scientific Societies and Public Responsibilities." 196 Annals of the New York Academy of Science (1973). Argues that professional societies cannot assume a neutral and value free position with regard to social issues.

Primack, Joel, and Frank von Hippel. Scientists in the Political Arena. (New York: Basic Books, Inc., 1974). Case studies of how scientists fulfill their social responsibilities in the political context.

Regan, Charles. Ethics for Scientific Researchers. (Manhattan, KS: Kansas State University Press, 1969). Includes cases, discussion of the special problems associated with research, and an introductory survey of major ethical theories.

Rabinowitch, Eugene. "Responsibilities of Scientists in the Atomic Age." 15 Bulletin of the Atomic Scientists (January 1959): 2-7. Discusses the problems of the scientist's conflicting loyalties, and examines the role of the scientist in educating the public.

Russell, Bertrand. "The Social Responsibilities of the Scientist." 131 Science (February 1960). Argues persuasively that scientists must accept their social responsibilities if the world is to survive and prosper.

C. PROFESSIONAL ETHICS IN ENGINEERING AND THE APPLIED SCIENCES

Alger, Philip T., N.A. Christensten, and Sterling P. Olmsted. Ethical Problems in Engineering. (New York: John Wiley & Sons, 1965). Opinions of practicing engineers on sample cases of ethical problems in the major fields of engineering.

American Society of Civil Engineers. Conference on Engineering Ethics. (New York: ASCE, 1975). Includes case histories, discussion of engineering codes, problems of enforcement, and proposals on how to educate ethical engineers.

American Society of Civil Engineers. Ethics, Professionalism and Maintaining Competence. (New York: ASCE, 1977). Conference proceedings discuss engineering ethics and professional education, and the problems of maintaining professional qualifications.

Baum, Robert J., and Albert Flores, eds. Ethical Problems in Engineering. (Troy, NY: Center for the Study of the Human Dimensions of Science and Technology, 1978). Contains articles analyzing ethical problems of the engineer, several codes of ethics, and numerous theoretical and actual case studies.

Blickwede, Donald J. "The Societal Responsibilities of Industrial Research." *Research Management* (September 1976): 7-8. The author reviews traditional perspectives on the corporation's social function, discusses the problems of government regulation, and assesses the implications of technology.

Collins, Frank. "The Special Responsibilities of Engineers." 196 *Annals of New York Academy of Sciences* (1973). Argues that engineers working as part of a collective effort should accept responsibility for consequences of these efforts.

Jones, Russel C. "Kickbacks Versus Professional Ethics." *Engineering Issues* (July 1975). What the engineering profession can do, and what it has done, to prevent members from engaging in illegal and unethical practices when dealing with public officials or when acting as public officials.

Layton, Edwin T., Jr. "Engineering Ethics and the Public Interest: A Historical View." *American Society of Mechanical Engineers Publication*, 76-WA/TS-9. Provides sample cases to illustrate the difficulties associated with making engineering societies more conscientious in fulfilling social and ethical responsibilities.

Mantell, Murray I. *Ethics and Professionalism in Engineering*. (New York: Macmillan Publ. Co., Inc., 1964). Contains an interesting methodology for dealing with ethical problems raised by engineering practice.

Parker, Donn B. *Ethical Conflicts in Computer Science and Technology*. (Menlo Park, CA: Stanford Research Institute, 1978). An analysis of nearly 50 scenarios depicting ethical problems created by the use of computer technology, by a national panel of experts, including lawyers, philosophers, sociologists, and members of the computing profession.

Report of the Secretary's Advisory Committee on Automated Personal Data Systems, U.S. Department of Health, Education, and Welfare, *Records, Computers and the Rights of Citizens*. (Cambridge, MA: M.I.T. Press, 1973). Examines the problems of applying computer technology to record-keeping and the responsibilities of the collectors and custodians of that data.

Task Committee on Professional Civic Involvement. "Action Program for Elimination of Unethical Practices in the Engagement of Professional Services." *Engineering Issues* (April 1975). A realistic appraisal of current practices and a program proposal aimed at aiding civil engineers.

Whitelaw, Robert L. "The Professional Status of the American Engineer: A Bill of Rights." *Professional Engineer* (August 1975). Contrasts the engineer with other professions and argues that engineers' professional rights need protection from organizational infringement.

D. ETHICS IN THE HEALTH PROFESSIONS

Aikens, Charlotte A. Studies in Ethics for Nurses, 2nd edition. (Philadelphia, PA: W.B. Saunders Co., 1923). Approaches ethics from the view of the nurse's role. Although outdated, it provides an interesting perspective on how responsibility is grounded in roles.

Beecher, Henry K. Experimentation in Man. (Springfield, IL: Charles C. Thomas, 1958). Careful and useful evaluation of the ethical problems associated with medical research by a practicing physician and researcher.

Brody, Howard. Ethical Decisions in Medicine. (Boston, MA: Little, Brown & Co., 1976). Programmed text contains sixty cases for analysis, with philosophical commentary.

Ellison, David L. The Bio-Medical Fix: Human Dimensions of Bio-Medical Technologies. (Westport, CT: Greenwood Press, 1978). The value implications of new technologies in medicine (e.g., kidney machines).

Fuller, George D. "Current Status of Biofeedback in Clinical Practice." American Psychologist (January 1978). The use of biofeedback by clinicians raises various issues, including several ethical problems.

Gorovitz, Samuel, Andrew L. Jameton, Ruth Macklin, John M. O'Connor, Eugene V. Perrin, B.P. St. Clair, and Susan Sherwin, eds. Moral Problems in Medicine. (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1976). Massive collection of articles on the major ethical problems affecting the medical profession.

Illich, Ivan. Medical Nemesis: The Expropriation of Health. (New York: Pantheon Books, 1976). Critique of the medical profession.

Johnson, Arlien. "Professional Standards and How They Are Attained." 31 Journal of American Dental Association (September 1944). Interesting historical piece.

Masters, William H., Virginia Johnson, and Robert C. Kolodny. Ethical Issues in Sex Therapy and Research. (Boston, MA: Little, Brown & Co., 1977). A new field generates new problems requiring careful attention.

Starr, Paul. "Medicine and Waning Professional Sovereignty." Daedalus (Winter 1978). Historical and political analysis of medicine's control of medical resources and health care.

Veatch, Robert M. Case Studies in Medical Ethics. (Cambridge, MA: Harvard University Press, 1977). Useful text with 112 cases and commentary on the major issues in medical ethics; also focuses on the problems of decision making.

Watson, Goodwin. "Moral Issues in Psychotherapy." 13 American Psychologist (October 1958). Argues that "moral therapy" is impossible; examines the need for psychotherapy in religion.

Wolkovich, William L. Norms of Conduct for Pharmacists. (Clinton, MA: William L. Wolkovich, 1962). Illustrates that pharmacists also have ethical duties in the practice of their profession.

E. PROFESSIONAL ETHICS IN THE SOCIAL SCIENCES

American Psychological Association. Casebook on Ethical Standards of Psychologists. (Washington, DC: American Psychological Association, 1967). Collection of actual cases illustrating how the APA code of ethics is applied and interpreted.

Levy, Charles S. Social Work Ethics. (New York: Human Sciences Press, 1976). How can work that is "social" be anything but "ethical"?

Rosen, Laurence. "The Anthropologist as Expert Witness." 79 American Anthropologist (September 1977). The appearance of anthropologists as expert witnesses often raises difficult ethical problems; this article reviews sample cases and proposes standards regulating this activity.

Sjoberg, Gideon, ed. Ethics, Politics, and Social Research. (Cambridge, MA: Schenkman Publishing Co., 1967). Articles examining the interrelationships and problems associated with each area.

Ward, Leo R. Ethics and the Social Sciences. (South Bend, IN: University of Notre Dame Press, 1959). Papers from a conference aimed at defining the common ground of social science and ethics.

West, Stephen G., and Steven P. Gunn. "Some Issues of Ethical and Social Psychology." American Psychologist (January 1978). An examination of current methodologies and an evaluation of their implications.

DISASTER THRILLERS: A LITERARY MODE OF TECHNOLOGY ASSESSMENT

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Whether or not one agrees with the notion that technology is neutral until put to use, it is difficult to ignore the present rush to explore technology's unneutral aspects. Environmental impact statements, establishment of the Office of Technology Assessment, increased discussion of biomedical ethics, and the NSF and NEH EVIST programs--all are signs of an increasing reluctance to accept a technology before carefully examining the costs and benefits and the value-conflicts involved.

Besides the formal, official modes of technology assessment sanctioned in government, industry, and the academic world, there is also an aesthetic or literary mode which, although entirely unofficial, can affect millions of American citizens annually. I am referring to those popular disaster novels in which some technology or technological system threatens or actually brings about a public disaster. Such literary works attract a great deal of attention, and frequently are made into successful films. In addition, their popularity suggests that they may reflect and/or influence the views of large numbers of citizens.

For this reason, and because the images of technology contained in these books might, through one political channel or another, also influence official attitudes, it is worth looking at a few representative thrillers to see what sort of technology assessment they contain. Is there serious discussion or presentation of current or probable technologies? What is the relation of this material to the story as a whole? Is policy or reform suggested or implied? How is the role of government portrayed? After surveying several representative novels with these questions in mind, I will briefly outline some broader issues raised by the popularity of this genre. The works discussed below were chosen for currency and variety, but much of what is said about them pertains to a host of other popular novels.

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With over five million copies in print and more than one successful movie in its image, Arthur Hailey's Airport (1968)[1] is emphatically part of American popular culture. Its plot follows the attempt of a demented suicide-bomber to blow up a fully-loaded transatlantic passenger flight in order to secure flight insurance money for his family. All this is woven into the background of normal operations at a busy international airport, with the added complication of a nearly disabling blizzard. The bomb goes off in the air, but the pilots manage to land safely in spite of the blizzard, a blocked runway, and a bomb-damaged tail section. The airport system survives all these threats to its integrity, thanks to the sound intuition and stoic devotion to duty of airport and airline personnel performing well beyond the limits of their job descriptions.

Hailey attempts to demonstrate that the large modern airport is an immensely complicated combination of subsystems, many of which have technical components. Although in this novel the systems are tentatively under control, ultimately airports are subject to political, social and technological forces outside their control, and their integrity is constantly threatened by human weakness, selfishness, and, paradoxically, by the challenge of new aircraft designs. Hailey devotes a considerable part of the narrative to the professional pressures on airport personnel, focusing most intently on air traffic controllers, whose work requires them to maintain simultaneously a "tense mental sharpness" and a "controlled, studied calmness"--conflicting demands that can produce psychological stress and thereby threaten public safety.

Three recommendations for changes in airport operation may be identified in the book, and Hailey, who was an R.A.F. pilot in World War II, obviously wants us to take them seriously. First, airport ground facilities are, often dangerously, lagging behind aircraft design--a situation calling for attention by planners at municipal, state, federal, and international levels. Second, Hailey argues that the sale of flight insurance in airports constitutes an open invitation to desperate and dangerous action, and should be eliminated. Third, for air traffic controllers, Hailey recommends higher pay commensurate with the tensions and critical nature of their work, and early retirement before the tension takes its toll.

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Thomas R. Scortia and Frank M. Robinson's The Prometheus Crisis (1975)[2] is the story of a catastrophic coming-on-stream of a gigantic nuclear power complex on the California coast. The date is about 1990, but, except for the fact that a complex of this size does not now exist, the setting might as well be the present. The novel's conflict occurs over whether the plant is ready to bring up to full power. The only major character opposed is project manager Gordon Parks, a nuclear engineer and perfectionist, who feels that the plant needs more testing before it goes on line. On the other side are politicians (the President wants no brownouts with an election coming up), the utilities (in part because they fear the loss of political favor), and the facility's own computer-assisted monitoring system (core sensors have flickered, but have given no official warning). Under pressure, Parks finally compromises, extracting from the utility management a promise to back out if anything goes wrong. When an apparently minor defect does appear, the utility breaks its promise and fires Parks. Things get worse under an inept replacement and by the time Parks is reinstated the situation is past recovery. Containment is breached, and radioactive fallout destroys a local fishing village. An attempt to seal off the melt fails because a dynamite charge was badly underestimated by a computer program, and with a shift in the wind the cloud reaches and devastates the entire Los Angeles basin. Evacuation, which had been considered impractical, was never attempted.

Scortia and Robinson clearly expected their novel to reach a wide audience, and it has been fairly successful.[3] The authors also intended their story to be understood as realistic. The fact that one of the authors is a scientist (Scortia was an aerospace physiochemist) is made known, and the long disaster sequence is filled with technical detail, all of which seems credible to a reader with a basic lay knowledge of the technology. The authors enhance this impression of realism by pointing out, in an afterword, several details with which they have taken artistic license. Finally, the afterword includes the statement that, although the novel does not constitute a prediction, the authors are "more than a little afraid" that facts may catch up with their fiction.

Thus The Prometheus Crisis is a literary contribution to the real-world debate over nuclear power. The heart of the novel is the dramatization of a plausible chain of faults in current fission technology which lead to catastrophic plant failure: unreliability of manufactured products and construction processes; the domino effect, by which failure of one component places additional strain on others; inadequacy of the emergency core cooling safety backup system; and human laziness and political pressures that are not directly related to the mechanics, but significantly affect the procedures by which the mechanics are designed, tested, operated, and evaluated.

Besides bringing these and other defects to life in dramatic sequence, Scortia and Robinson also attend to the conflict between the political and the engineering approach to high-risk situations of low probability. In the battle between Parks and the politicians, it is clearly Parks who is in touch with the situation. The politicians are distracted by forces unrelated to nuclear technology and are unable to grasp the complexities involved. They simplemindedly approach the Prometheus decision with the expectation of compromise, an attitude which, while it keeps political wheels turning, is shown to be inappropriate in technical matters involving high risks.

The political sector is thus part of the problem. By exerting pressure on the utility, politicians make it next to impossible for the engineer with the right instincts to do what he feels is proper. Another fault of the political-industrial system is that, in suppressing sources of negative feedback, it shows an unhealthy inability to learn from its mistakes. The principles who survive the disaster are bribed with attractive jobs. Parks refuses and finds his reputation smeared in congressional hearings and in the media. His testimony on political pressure and mechanical and computer failure is whitewashed with a story of sabotage--politically more desirable because it transfers the responsibility, and because action can be taken to prevent its recurrence. The Prometheus Crisis is indeed a cynical and pessimistic view of the prospects for current nuclear technology--one that might well cause a reader to question the findings of certain official nuclear power safety studies which, while generally rigorous within their own terms, choose to downplay or exclude from consideration a number of the factors in Scortia and Robinson's scenario.

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No discussion of modern technology is complete without a biological section, an area in which Michael Crichton's The Andromeda Strain (1969)[4] is the mass-market classic. The Andromeda Strain, of course, dates from the primitive times before recombinant DNA. Crichton's scientists, under contract to the Department of Defense, attempt to build up the nation's biological arsenal by launching satellites into the upper atmosphere in hopes of bringing back useful biological agents.

A high-powered, ultra-secret, and somewhat futuristic medical research effort is organized to discover the nature of an active agent (code name: Andromeda Strain) that has returned with one of the satellites, and to work out an antidote. The book's medical mystery and scientific brainstorming are well done, and the technology used to facilitate medical diagnosis and guarantee security is convincing as well as entertaining. The book begins with an acknowledgement worded as if the events had actually happened, and ends with three pages of technical background references that look absolutely convincing but are pure fiction.

But all that is for effect. Crichton's serious subject is the risk involved in science and government working together in complex biological areas, where knowledge is scant and control difficult at best. At the end of the book, the organism is over Los Angeles--apparently a favorite target for writers--and seems to have mutated into a benign form. The research team is working with its cultures, and the hope is that they will soon "understand" the organism. Crichton undercuts that hope in a fictional epilogue which reveals that the Americans and the Soviets have each lost a spacecraft through unexplained mechanical failure, and that NASA has cancelled all further manned flights pending the report of an investigative committee.

Even without the epilogue, the faith of the research team seems unrealistic because it conflicts with a number of details in the novel that establish a broadly cynical view of scientific and technological certainty. A slight shredding of a roll of teleprinter paper quietly knocks out a top-priority communications link even though it is equipped with an automatic electronic default warning system. The building within which the investigation takes place has a blatant flaw in its construction (although not in its blueprints) that almost causes the death of the entire team. At several points in the investigation, the nation's best scientists become too optimistic about the progress of the search, with the result that important clues are missed and time wasted. Moreover, the book begins with ironic epigraphs attributed to the book's fictional scientists: "The survival value of human intelligence has never been satisfactorily demonstrated" and "Increasing vision is increasingly expensive."

Thus in The Andromeda Strain technology is not under control, and government is again part of the problem. By supporting "the largest scientific establishment in the history of mankind," the United States has produced a professional culture of ingenious people and many generations of marvelous machines, but in the process has generated side effects beyond the capabilities of those people and that machinery to control. Crichton's literary mode is fanciful but his message is serious, and he raises important questions about both the dynamism of Western civilization and our ability to control scientific research.

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A more contemporary dramatization of Crichton's syndrome of concern appears in Scortia and Robinson's most recent collaboration, The Nightmare Factor (1978)[5], one of many recent disaster or sensational novels on biomedical subjects. The Nightmare Factor describes an outbreak of a mysterious pneumonia-like disease among some California conventioneers and the medically and politically complicated investigation into its nature and cause. The epidemic turns out to be an accidental side-effect of a clandestine experiment on the conventioneers with a biological warfare agent produced with recombinant

DNA techniques in laboratories under contract to the U.S. Department of Defense. The viral agent was intended to be accurately targetable (it was non-infectious and viable only in the presence of vanadium) and subtle yet devastating in its effects (spliced in was a teratogen which, without harming its host, would permanently prevent human fetuses from coming to term). What the designers did not foresee was that antibodies produced by the first exposure to the virus sensitized the victim to a second exposure.

The similarity to Crichton's book is obvious. However, in The Nightmare Factor, scientific techniques have advanced from random, ineffective searches for agents to the tailoring of them in laboratories, and the more active participation of the U.S. government makes things a good deal more malign. In Scortia and Robinson's novel, the World Health Organization medical idealists slow down but clearly do not stop the nationalistic scientist-pragmatists, who see the world as a "jungle" in a state of "war." "It's a sad burden that scientists carry," the novel's philosopher remarks, "that their most cherished technologies become weapons of war."[6] A similarly pessimistic remark of Erwin Chargaff's (he is mentioned by name in the book) is a recurrent motif: "It begins with the do-gooders and ends with the exterminators."[7] The book's title comes from the fictional philosopher's final lines, in which he describes his ultimate fear--that mankind will eventually fight a losing war against one of its own escaped creations.[8] The title thus refers to a possible disaster that does not take place in the novel, and is therefore somewhat misleading, although not unrelated to real public concerns over rDNA research, or the "escape" of toxic agents.[9]

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Noel Mostert's Supership (1974)[10] is a non-fictional narrative about supertankers. Although not a novel, it takes what might be called a literary approach to its subject, and thus makes an interesting complement to the works already discussed. Supership is actually a treatise in the form of a travelogue. The overall framework is a description of the author's voyage on the 200,000-ton S.S. Ardshiel from Rotterdam around the Cape of Good Hope to the Persian Gulf to fill her tanks and back again to unload in the Mediterranean. Mostert's thesis is that supertankers as a lot are badly designed, built, sailed, and regulated, and that the world's oceans will not long survive our present careless use of this technology.

Others have said similar things before, but what makes Mostert interesting is the literary strategy of basing his arguments on the seagoing experience. Supporting Mostert's analytical presentations on the history of shipping, marine casualties, and international patterns of energy consumption, are the sailors' impressions (and Mostert's own) of the Ardshiel, of other tankers, and of the seas they have sailed. Throughout, Mostert shows that the uneasy feelings of those who actually sail these huge machines are a reliable index to those aspects of supertanker technology urgently needing public appraisal.

The feelings Mostert emphasizes are those of being at sea on something that does not look or feel like a ship, on which one is dangerously removed from the sea and, in time of crisis, a victim of a nearsighted economic system. Behind these feelings lie the supertankers' gigantic scale, defective design, and heavy automation. The larger vessels, referred to as VLCC's

(Very Large Crude Carriers, from 200,000 to 300,000 tons capacity) and ULCC's (U is for Ultra, over 300,000 tons), are almost a quarter of a mile long. The bridge of the Ardshiel is 45 feet (five stories) above the deck and, on return trips, 113 feet above the water. From the bridge, located far astern, the view forward is of acres of metal. When there is work to be done near the bows, orders are given by radio, the crew goes forward on bicycles, and the officer on duty in the bridge monitors the work by telescope. Normal seas do not affect the tankers. Precisely because they are so long, however, the hulls are subject to great overall stresses under certain conditions. And, in a battering sea, serious bow damage can go undetected. "You never know what's happening," complains the Ardshiel's first mate.

Size is not the supertanker's only design problem. In order to maximize profits, tankers are built cheaply and scandalously short of redundant systems for power, propulsion, navigation, or flotation. They are usually written off in ten years, and, Mostert reports, often develop chronic troubles before that time. When damage is discovered or malfunction occurs, these vessels can be in serious trouble--without backup systems, too big to repair at sea, often far from a deep water port, and difficult to tow. In navigational emergencies, the VLCC's are virtually unsteerable and unstoppable.

The isolation of a VLCC crew from the sea's forces combines with a high degree of automation to create new hazards. Boredom and dulled senses, almost inevitable in an abstract environment, constitute a major safety problem that, Mostert notes, has not been taken into account in the justification of the VLCC's over smaller ships. There are also problems directly related to control of the ship's systems. Automation, the sailors told Mostert, "undermines much of the old-fashioned vigilance" and permits engineers to "lose their occupational instincts"--qualities which in earlier days of shipping served as an invaluable safety factor. Checking automatic systems seems absurd, but if they fail, what then? Mostert and the crew members he cites feel that it is better not to have the temptation to neglect vital functions at sea.

The big new tankers have become as unsafe as they are, Mostert says, because board room greed has not been tempered by respect for the sea's unforgiving qualities. The haste and innovation characteristic of the supertanker race of the last two decades is entirely "alien to the seagoing experience," which inculcates caution and conservatism. Because supertankers combine high investment return with unique importance for international energy supply, they are as hard to stop politically as they are navigationally. Nevertheless, some economic, political, or environmental pressures could force gradual changes in design. Rising insurance premiums may be expected to have some effect. Charging cleanup costs and punitive fines to the owners would internalize expenses that have previously been absorbed by the world at large, or by the affected country. Mostert also recommends such things as twin screws, double bottoms, health exams and "environmental" training for masters, an international court of marine justice, and (until such a court evolves) unilateral action by suffering nations to force improved environmental and navigational standards.

Summary Remarks

The works discussed above describe the machinery and procedures with which humans have attempted to control, for their own benefit, the skies, the seas, the structure of matter, and the structure of life. In each book a system of increased complexity or audacity leads to an instability that endangers the public welfare. The novels vary considerably in their approaches to their subjects and in their hopes for the restoration of stability, but, as one might expect of literary works, all emphasize the importance of individuals and human factors. For better and for worse, the function and impact of technology is strongly influenced by those who serve it and those whom it serves. These books share an interest in other factors less easily quantified and which tend to be played down or neglected in official assessments of technology--broad philosophical and moral questions, for instance, and unique or improbable events of great consequence. Whatever the factor, in every case the literary form increases the persuasiveness of the author's particular assessment. The fact that large numbers of readers willingly read stories about technology is principally due to the fact that those stories are played out in terms of imaginatively rendered human lives. The chance that those readers will be swayed to the author's views is greatly increased by narrative's well-known ability to effect suspension of disbelief.

One frequent objection to considering such works as serious discussions of technology is that they may dramatize events that are technically implausible. The question of plausibility is an important one, but it does not provide a rationale for dismissing these works altogether. For one thing, informal review of individual works by the scientific community and the science press can serve to identify clearly implausible works.[12] In many cases, however, there will be a spectrum of informed judgment concerning a particular novel's plausibility, not because the book is sensational or otherwise, but because the same spectrum is characteristic of real-life views of the subject technology. Also, in assessing the significance of these works, it is important to remember that they can influence the public imagination without being perfectly plausible. Disaster thrillers primarily seek to convey not precise information but something more diffuse and generalized--an experience on which ideas and attitudes may be based. Because they are associated with an intense, engrossing experience, such ideas and attitudes may persist in spite of some evidence of their implausibility. Thus, the nature of the information these works convey about technology is a critical part of their effect on the public understanding of technology.

To move from public attitudes to public policy, we have to know how, if at all, the messages of these books could have influenced their subject technologies. One frequently encounters strong resistance to the idea that a novel can make something happen, as though a literary taboo were threatened. Yet there are many novels which have influenced public policy. Upton Sinclair's The Jungle, for example, was notably instrumental in the passage of the Pure Food and Drug Act in 1906. The Andromeda Strain caused some controversy during the final preparations for NASA's Apollo-11 manned lunar mission, and through the format of congressional hearings, was instrumental in persuading NASA to redesign its containment policies for returning astronauts and lunar samples.[11] There is every reason, then, to regard the disaster thriller as a literary work with, at least, the potential to influence public policy. The requirements for influence would seem to be three: (1) a frightening story, (2) a modicum of scientific and technical credibility, and (3) exposure to a large audience. Critical exposure may not come until a novel has been made into a film, or another film with a similar plot exploits the same theme (for example, a forthcoming Hollywood film, "Power," features an accident at a nuclear power plant). Films, of course, can have an impact independent of novels, and much of the previous discussion applies to them or any narrative that concerns technology and meets the above three requirements.

A final question raised by these works is that of the legitimacy of their effects. Do these effects constitute a proper and desirable approach to managing technology? The answers, if indeed there are any, lie beyond the scope of this paper. One point worth noting briefly, however, is that disaster thrillers have an interesting relation to the recent shift toward increased public participation in decisions affecting technology, particularly in the referendum process. This movement has much to recommend it, with its goals of a more informed public and wiser, more equitable decisions. It is possible to imagine disaster thrillers serving the same goals. Yet there are dangers as well--for the referendum, frequently a gap of sophistication between public understanding and the issues at hand, and for disaster fiction, sensationalism and oversimplification. The combination of these two democratic creations could lead, by cultural inbreeding, to an undesirable loss of complexity in social responses to technological issues.

In 1975, in Austria, where the debate over nuclear power had been intense for several years, a local radio station produced a fictionalized dramatization of the explosion of that nation's only nuclear power plant (which at that time was not yet on-line). The radio program produced a minor panic.[12] In a November 1978 national referendum, Austrians voted not to bring this plant into operation, even though it had been completed at the cost of $650 million. The vote was close. If 15,000 (out of 3 million voting) had voted for nuclear power instead of against it, the decision would have gone the other way. Was the radio program possibly a critical influence? Was it a proper influence? Did it lead to enlightened policy? Such things are notoriously hard to measure and judge, yet, as remote as the answers seem, the questions are worth asking. Disaster thrillers, whatever we think of them, will undoubtedly continue to find a large audience and, thereby, sharpen public attitudes toward technology in ways that may, along one route or another, come to affect the technological future.

NOTES

1. Arthur Hailey. Airport. (New York: Doubleday & Co., 1968; New York: Bantam Books, 1969).

2. Thomas R. Scortia and Frank M. Robinson. The Prometheus Crisis. (New York: Doubleday & Co., 1975; New York: Bantam Books, 1976).

3. *The Prometheus Crisis* has, to date, sold about 300,000 copies and may be produced as a film.

4. Michael Crichton. *The Andromeda Strain*. (New York: Alfred A. Knopf, Inc., 1969; New York: Dell Books, 1970).

5. Thomas R. Scortia and Frank M. Robinson. *The Nightmare Factor*. (New York: Doubleday & Co., 1978).

6. *Ibid*., pp. 173-174.

7. *Ibid*., pp. 26 and 313.

8. *Ibid*., p. 335.

9. See, for example, the news story on the escape from a USDA P-4 laboratory of the virus that causes foot-and-mouth disease (*Science*: 20 October 1978, p. 290; and 17 November 1978, pp. 723-724).

10. Noel Mostert. *Supership*. (New York: Alfred A. Knopf, Inc., 1974; New York: Warner Paperback Library, 1975).

11. The residual effects of this debate may still be seen in the scientific discussion of handling future samples from Mars.

12. See Dorothy Nelkin and Michael Pollak, "The Politics of Participation and the Nuclear Power Debate in Sweden, The Netherlands, and Austria." 25 *Public Policy* 3 (Summer 1977): p. 350.

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SPRING 1979--Technology and Society: Images, Issues, Criticisms, Policies.

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THE ETHICAL PRINCIPLES OF SCIENTIFIC INSTITUTIONS*

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Corporations, Chief Justice Coke remarked in 1612 in an English judicial decision, cannot commit treason or be excommunicated "for they have no souls."[1]

It was the ecclesiastical corporation of which Coke was wary, in an age in which the hopes of mankind still centered on salvation, and the church was the institution with a basis of power beyond the control of the state. Later, when prosperity began to rival salvation in popular interest, and property became the basis of a form of power rivalling politics, Coke's successors in jurisprudence became concerned with the business corporation. And today, when our hope of peaceful progress depends on the use or restraint of science and technology, we wonder whether research in the scientific institution--the new form of corporate organization with a magic that the politician cannot readily manipulate--can be brought under some form of ethical guidance.

The scientific institution may have no soul, but it is made up of individuals whose concern for the effects of their work on the future of humanity is growing. Scientists, like other intellectuals, are losing their faith in the automatic beneficence of the advancement of knowledge, and groping for some way to bring its future impact on humanity under the control of humane values.

Such concern sometimes takes the form of lonely protest: a single scientist may rebel against the use to which society may propose to put his knowledge. Or it may take the form of organized political action to influence the policy of government. The horror of nuclear weapons led some scientists to renounce any research that could contribute to military purposes, and others to organize to lobby for national or international controls over atomic energy. But it is apparent that purely individual action may be futile, and participation in national politics may risk a surrender of the degree of independence that a scientific institution cherishes.

It may be more effective to deal with issues by taking part in the processes of institutional decisions. Ethics involves not only good intentions, but practical consequences, and the decisions and actions that have the greatest effect on society are made within organizations. It is hard for the traditional scientist to think in these terms, even when his priorities are determined by the policies of his laboratory, or the topics of his research are influenced by the funding decisions of big government or big philanthropy. The incentive system of his calling leads him toward work that can be appraised in clearcut terms of truth or falsity, rather than toward the complexities and compromises that characterize institutional decisions. Such a temperament, when combined with a sensitive conscience, may lead a scientist to either of two extremes: to insist on the pursuit of scientific truth without regard for its effect on others, or to accept too much personal guilt for the social decisions that determine the eventual use of his discoveries.

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* Prepared for Nobel Symposium No. 44, Stockholm, Sweden, August 21-25, 1978, on "Ethics for Science Policy."

If ethical thought is concerned not only with benevolence but also with the ways in which it is translated into beneficent results, it will have to deal not only with specific decisions regarding the control or direction of research, but also with the way in which scientists develop the institutional system that controls those choices, and the relation between it and the broader political society. Aristotle held that in the perfect state the virtue of the good man is the same as that of the good citizen.[2] Today the ethics of the scientist must include a theory of good citizenship on the part of scientific institutions--in relation both to the ethical concerns of the individual and to the policies and power struggles of the state as a whole.

Varieties of Institutions, Issues, and Ethical Theories

Any such theory must take into account the widely varying types of scientific institutions, and the issues that confront them. Among the institutions, the university laboratory and the scientific academy may be dedicated to the advancement of basic science by research and education. The consulting firm or the "think-tank" may specialize in the solution of practical problems, with some mixture of fundamental research. The laboratory in the industrial firm or government agency may concentrate on the conversion of science into practical developments, and look to universities and other institutions as the source of its basic innovations. The teaching hospital may similarly draw on universities for its more theoretical research, but supplement that research in its own laboratories and relate it to clinical practice.

If the institutions with which we are concerned are bewildering in their variety, so are the issues.[3]

Some of the ethical problems arising in a research program have to do with research procedures and methods.[4] Public concern is readily aroused over such issues as experimentation on human subjects, or research that exposes the public to various hazards. How can one tell whether the informed consent of a research subject justifies potential harm, or balance the risks of a research project against potential benefits to science or to human welfare? Other issues arouse little concern outside the ranks of scientists themselves, unless they become relevant to some dramatic event. The objective reporting of data, the giving of due credit to sources of information, the prompt publication of new findings--these obligations are enforced in most cases only by the consensus of one's colleagues.

Since the ethic of science demands freedom to explore knowledge without boundaries, it is only recently that scientists have acknowledged constraints with respect to the subject matter of research. Work on some subjects may be restricted because of its dangers to society, either those resulting from accidents, or from the temptation to convert new discoveries into dangerous technology--weapons of mass destruction, or lethal genetic developments. How may one balance risks against benefits, and be confident of one's estimate on either side of that balance sheet? Some philosophers and a few scientists go beyond these pragmatic concerns and worry about the excessive development of scientific knowledge as such, distorting the human spirit for lack of other modes of learning.

These issues of either research procedures or of research topics are issues that often may be dealt with by the prohibition of improper or dangerous actions. They attract attention among scientists both because they are intrinsically important--who could fail to be frightened by such possibilities as the contamination of future generations by nuclear wastes, or their deformation by genetic accidents?--and also because they invite intervention by government in ways that would impair the autonomy of scientific institutions.

Other issues can less readily be dealt with by "thou shalt not" commandments; they arise within institutions in ways that are much less apparent to the general public.

What is the ethical obligation of a scientific institution to maintain balance within its program? How does it decide how much of its resources to devote to the education of the next generation of scientists by comparison with the support of the present scientific leaders, or to basic research by comparison with applied, or to highly specialized subjects by comparison with those involving wider interdisciplinary considerations?

Finally, an institution must face questions as to the relation of its ends to its means. How much should it alter its ideal purposes in order to get financial or political support? How much is it justified, as it tries to explain esoteric science to lay politicians, in avoiding precise scientific terminology and using popular language that carries connotations more favorable to its case? How rigidly should it undertake to defend its autonomy on issues of methodology, substance, or program balance, in cases where the public or the government becomes concerned?

These latter types of issues--those of program balance, and of the relation of ends to means--involve much less in the way of apparent risks to the public, and offer much less in the way of temptation to politicians to intervene in scientific affairs. Yet in the long run they may be as important for the future of science and its relation to society. They involve obligations that cannot usefully be imposed on scientific institutions by law or political authority, and that therefore should weigh all the more heavily on their corporate ethical sense. While, as Coke remarked, corporations have no souls, their directors may well acknowledge some standards of obligation (beyond the requirements of law) to the general public, as more and more business corporations are now feeling pressed to do. Scientific institutions, accordingly, are now aware that the obvious impact of science on modern society requires them to go beyond the traditional ethic of basic science, and accept as well an ethic of practical utility, and manage somehow to reconcile the two.

The ethic of basic science, of course, emphasizes those values that most effectively advance fundamental knowledge: respect for verifiable truth, for universal standards uncorrupted by national prejudices, for the publishing of data to be critically scrutinized by others, and for an attitude of disinterested objectivity rather than a desire for wealth or power. The sense of fellowship within the community of science and its dedication to the pursuit of truth are founded on these ethical standards.[5]

The ethic of practical utility affirms the obligation of science to contribute to the general welfare as well as to advance knowledge. This purpose may be stated in utilitarian terms, or in terms of a concern for justice and equality, or of loyalty to some political theory, such as a democratic ideal or a revolutionary ideology.

To try to mix the ethic of basic science with that of practical utility is an approach that lacks the clarity and rigor of the philosophy of Jacques Monod, who held that objectivity is the only value compatible with science, "whereas ethics, in essence *nonobjective*, is forever barred from the sphere of knowledge."[6] His austere doctrine, however, holds little appeal to the majority of contemporary scientists who seem more and more convinced of the need to reconcile the purposes of science to those of society.[7]

This conviction, of course, is hardly new. It dates back at least to Francis Bacon and the founders of the Royal Society in London, who saw little inconsistency between the more basic and the more practical purposes of science, which existed (as the 17th-century formula put it) both "for the glory of the Creator and the relief of man's estate."[8] This formula, however, like many later ones, provided no very precise method for reconciling the conflicting purposes of science. More recently, of course, the fashion has changed from religious to political formulas without a great deal of improvement in precision. As the earlier faith in revelation has dwindled, so has the later faith in revolution: outside the countries with one-party political systems (and perhaps even within some of them) there is decreasing confidence in the materialist dialectic as a basis for the ethical guidance of the scientist. Neither ecclesiastical nor ideological dogma seems to offer much help to the working scientists who must make practical decisions about their institutional programs.

Those who appeal to democracy as the basis of a scientific ethic may do less direct harm, but are not much better at producing specific guidance for ethical decisions. As a system that prevents irresponsible concentrations of power and maintains free and open criticism of ideas, democracy is a great safeguard for science. But the schools of moral philosophy in western democratic countries have not provided scientific institutions with unambiguous guidance about their ethical problems. The bewildering variety of contemporary thought in moral philosophy offers little guidance in the choice of a rationale, much less in the definition of a code of conduct. Intuitionist philosophers advise that it is useless if not impossible to define what is good, and the existentialists give so much weight to subjective thinking that they seem to leave the issues largely [up to] arbitrary choice. Other approaches try to develop universalizable principles, but require the calculation of the greatest good for the greatest number, or alternatively the least disadvantage or suffering all around, neither of which can usually be stated in clear equations.

Few institutional decisions on research priorities seem to be made with explicit reference to particular ethical theories. The general mood of American scientists probably reflects John Dewey's belief that value judgments are predictions about the way in which decisions will satisfy needs or interests, and that such predictions must be generalized and refined by practical experience. But the average scientist may be more skeptical than Dewey about the extent to which the social sciences may benefit by imitating the methodology of the natural sciences.[9]

Institutional Citizenship: Two Key Questions

Given this variety of institutions and the issues that confront them, it is hopeless to devise a formal code of ethics to control their specific research priorities. If we are to think about the ethical obligations of the institution--to devise, so to speak, a theory of institutional good citizenship--we should perhaps instead reflect on some of the issues that arise as a result of the new power of science in human affairs, and the inconsistency between that special power and the growing egalitarianism of modern politics. That inconsistency shows up in two key questions: (1) should the scientific institution have a special status in our social and political system, and (2) should it be responsible, and how, for bringing the results of science and technology under the control of humane values?

(1) The conflict between egalitarian conceptions of politics and the ethical obligation to advance basic knowledge appears in many issues of institutional policy and practical politics. For example, how much should a government spend for the higher education of the scientists of the highest ability, as against the broader education of average students? How much may scientific institutions claim exemption from regulations imposed on other institutions? How much money should go to basic research as against technology for immediate practical benefits?

The ethical imperative of equality has been expressed most influentially (among recent philosophical works in English) in John Rawls' Theory of Justice. His argument touches implicitly on the conflict between the claim of scientific institutions of high quality for a special status and support, and the egalitarian policy that (especially in America) makes it difficult to concentrate public funds in a few centers of excellence in advanced theoretical science.

Rawls' key argument is that no departures from a policy of equality are ethically warranted except those that work ultimately to the benefit of the least advantaged.[10] In practical American politics (whatever the case may be in arguments among philosophers) it is harder to oppose the general principle of equality than it is to expand the exceptions to the principle. This was indeed the tactic of the campaign by which the U.S. Congress was persuaded at the end of the second World War to devote massive funds to the support of basic research in a limited number of institutions.

When Vannevar Bush, at the request of President Roosevelt, presented his report Science the Endless Frontier in 1945, his most persuasive argument was of course not one in favor of the cultural advantages of science for a small number of the most highly talented researchers. Instead, it was that basic research is the foundation of applied technology, which in turn is so beneficial to the general public (in terms of health, wealth, and national defense) that it deserves a privileged degree of public financial support. The success of this tactic was measured by the billions of dollars in Congressional appropriations in the years that followed, and the unprecedented freedom granted to private research institutions in the spending of public funds.

American scientists are now troubled by a reversal of the trends that the Bush report initiated: for several years they have been getting less money and losing their exemption from burdensome regulations. This change, they fear, threatens the growth of basic research. Was this reversal of political fortune the result of a poor political tactic on the part of science? The argument that got the money was in terms of practical benefits for everyone, while the actual intention of the scientists was to use the money for basic research, with no very precise idea of its future practical use.

The original argument of the Bush report was honest and valid. The repetition of that argument, in justification of particular research grants, was more specious. This was not a question of actual deceit: the leading politicians knew what was going on, and encouraged the tactic in order to justify to their colleagues and the public their own enthusiastic generosity. But after some years, skepticism on this issue came to seem a virtue among politicians. As Robert S. Morison recently summarized the issue,

> ". . .the tax-paying public has been persuaded to supply for research unprecedentedly large. . .amounts of money on the promise of good things to come. When the good things don't come fast enough, this same public, taught by recent events to question the motives of all its leaders, stands ready to question even those of the scientific mandarinate."[11]

The nagging question remains: would it have been more ethical (and indeed more effective) for scientists to present their case for special support on a frankly elitist basis, affirming the value of basic knowledge in its own right, even though this value would never be shared by the average voter?

(2) Even more troublesome for scientists is the question of how much they and their institutions should be responsible if science and the technology derived from it lead humanity, through some dynamic of their own, in dangerous directions, without control by humane values. This fear, which came into popular consciousness with atomic weapons, now extends to the results of the biological sciences, in which the line between basic research and practical developments is harder to define and police. The Asilomar conference and the subsequent public discussions of the danger of research on recombinant DNA and related work in genetic engineering have alarmed scientific institutions as well as governments as to the limits that might be necessary on the search for new knowledge.[12]

Of even broader significance is the decline of faith in the idea of progress and especially in science as its driving force. This has taken the form, even among some scientists, of a fundamental distrust in the objectivity of scientific knowledge, or of objectivity as a proper norm of science.[13]

How may scientific institutions consider their ethical responsibility for the effects of new knowledge and new techniques on society?

One earlier answer was the formula which is often attributed wrongly to Max Weber:[14] The scientist should defend his ethical standards by drawing a sharp line between facts and values. Decisions on values are the responsibility of the administrator or the politician; the role of the scientist stops with the determination of objective truth. This approach was useful, perhaps, in establishing a line of defense against the political corruption of science. It was similar to the working principle on which the career bureaucracies of the United Kingdom and some western European countries were maintained: the expert should be "on tap and not on top"; both he and his superior, the career administrator, should leave the fundamental value choices to their elected superiors, at least in appearance.

But this was a formula that, for defensive purposes, was useful only so long as the inner workings of the governmental system were not open to public scrutiny, and as technology was exerting only a gradual influence on the course of public affairs. Recently, these two limitations have weakened, and the observations of the social sciences, especially as they have illuminated the sociology and politics of science, have confirmed what seasoned bureaucrats have long known: that the distinction between facts and values, as useful as it is conceptually, does not correspond to the difference in actual function between scientists and their professional allies on the one hand, and administrators and politicians on the other. New knowledge opens up the vision of new benefits which the public will wish to exploit, or of dangers which it will try to forestall, and scientists themselves will not be passive in arguing for either. Reciprocally, the desires of the electorate, transmitted through the political process, provide the impetus for new research, for example, the massive expenditures in search of a cure for cancer, and put constraints on the search for knowledge that may be dangerous.

The later answer is the more sophisticated approach of the so-called policy sciences. The applied social sciences have acknowledged the role of science in decisions about the value aspects of policies, and developed a new range of interdisciplinary techniques for the analysis of policy issues, and the evaluation of decisions and actions. For example, there is a considerable literature on the scientific methods for assessing various risks involved in technological innovations.[15] These studies are based largely on scientific and statistical methods, and consequently put considerable emphasis on those aspects of issues which can be treated quantitatively and verified by experience. The policy sciences are attacked by some critics for giving inadequate attention to philosophical and ethical issues, thereby increasing the bias in American politics toward the material and technological interests of society.[16]

The criticism may often be justified; it is hard for research on the costs and benefits of water resource development, for example, not to put more emphasis on the measurable benefits of irrigation and water power than on the recreational and aesthetic aspects of proposed projects. Yet it seems to me probable that precise calculation of the quantifiable aspects of a problem is a useful part of the process of recognizing and clarifying the broader values involved. Whether those values will get adequate consideration depends on the breadth of comprehension and sympathy of the researcher, which may in turn depend on his earlier training and experience.

As André Cournand argues, overspecialization is a threat to that breadth of comprehension--to the universalism of science and to its expression of concern for the general welfare.[17] Such overspecialization may be offset in various ways. Some scientific societies undertake to develop the interests of their members in the social implications of science, as the American Association for the Advancement of Science has done by a wide range of its studies. Some research institutions have undertaken studies on the policy implications of their basic sciences, as the Woods Hole Oceanographic Institution has done with respect to marine policy and ocean management, and the Battelle Human Affairs Research Center has done on the problems of the management of nuclear wastes. Some universities have developed special programs of professional education in which the more rigorous policy sciences have been supplemented by research and teaching on the ethical implications of those issues which scientific analysis helps to resolve.[18]

The two key issues of equality vs. special privilege, and of the accountability of science to other modes of knowledge or types of social institutions, cut across all the specific ethical issues that now vex scientific institutions. The problems become accordingly so complex that it is hopeless to try to deal with them by prescribing specific rules or formal codes of ethics. It may be more useful, in ethics as in science, to search for general abstractions rather than cookbook rules. Some psychologists observe that maturity in moral development requires progress from a simplistic reliance on specific rules of conduct to a commitment to a broader principle of universal benevolence.[19] This observation may owe less to the scientists' belief that the advancement of science depends on the discovery of broader and simpler principles of causal explanation, than it does to the philosopher's belief in the categorical imperative, or to the theologian's in the law of love rather than in specific commandments.

A simplistic reliance on some "golden rule" of unselfish benevolence does not readily solve the ethical issues which the individual must confront, much less the problems of the institution. Even the most unselfish person must reach some compromise, when dealing with others, between the law of love and principles of justice. The institution is even more constrained in this way than the individual; it is unfair for one individual within an institution to commit his colleagues to a course of self-sacrifice.[20] An institution, no matter how deeply its members may believe in the basic virtues, has to work out its dilemmas through political interaction with other institutions and with the authority of government.

Principles of Political Balance

If specific codes cannot be formulated for its guidance, are there any basic principles that could help a scientific institution resolve, on an ethical basis, the conflict between the ethic of pure science and that of practical utility, and to decide the degree of special status it should claim, and the extent of responsibility it should accept? Perhaps two such principles may be suggested.

The first is the denial of sovereignty: the affirmation that a scientific institution has rights and ethical responsibilities that should not depend on the will of any government. The second is the denial of scientism: the recognition that the ethical aspects of major policy questions cannot be answered by science, but must be determined by legal and political processes.

The ethical obligations of a scientific institution are not restricted to the advancement of knowledge, or the ethic of basic science alone. But there is no way to define in advance, for all situations, how far a scientific institution should go in trying to solve the broader political problems to which its research is related.

To work out this problem it is helpful for a scientific institution [to define clearly] its status in society and the way in which it shares responsibility with governmental authorities on the political results of its work. But here, too, the variety of institutions and of the issues with which they deal makes it difficult to devise uniform rules.

The value of the two principles suggested above is that they put limits on the pretensions and authority of both the politician and the scientist, and they admit the impossibility of merging the two roles completely, or justifying their authority on the same basis. Let us consider each of them in turn.

The Denial of Sovereignty   Science is not merely a tool of political power, of arbitrary value judgements, or of ideology. Almost all societies concede it some measure of institutional autonomy; a free society gives it a great deal. The principle stems from two convictions: truth is a paramount good, but political power is an unfortunate necessity. Sovereignty describes the ultimate authority that on occasion government may have to exercise. But a free society denies its moral claim to absolutism. That denial depends in part on the belief of those in authority themselves--a belief reinforced by the electorate's healthy skepticism, to which both science and theology have contributed, about the infallibility and unselfishness of those who occupy temporarily the seats of power.

The essential function of pure science is the pursuit of truth, without regard to purpose or practical effects. The essential function of politics is the exercise of power. Along the spectrum from truth to power, the function of certain quasi-scientific professions (e.g., engineering and medicine) is to mix pure scientific knowledge with social purpose, and the function of administration or management is to mediate between professional expertise and the power of politicians.[21]

These statements, of course, deal with functions, not with people. Science may be concerned solely with the search for truth, but scientists develop broader interests, and the more influential among them may slide imperceptibly into roles of a professional, administrative, or even political nature. The justification for granting autonomy to scientific institutions is neither to make those individual scientists more influential in political or administrative roles, nor to keep them out of politics. On the contrary, institutional autonomy is justified because it permits each scientist to take part freely in political affairs, and at the same time gives his scientific colleagues ample opportunity to discredit him if he tries to manipulate scientific data improperly in support of essentially political positions.

The individual scientist may be as tempted by power as anyone else. If the institutions that have the leading reputations in his field are fully independent, their members will be in a position to disagree with him freely if he tries to stretch scientific evidence in support of his policy objectives. It is easy to see how much the degree of independence of scientific institutions has in the United States affected the freedom of their members to disagree with the policies of the scientists who took leading roles in the national administration. On military issues like the Vietnam war, or civilian issues like the supersonic transport, it was obvious that overt and vociferous criticism of official policy came not from the government laboratories or from the so-called "think-tanks" (those research institutions dependent in part on government support) but from the scientists with tenure in universities. It was this split between the independent academic scientists and the Nixon administration that made untenable the positions of the President's Science Advisory Committee and its Chairman, and led to their temporary abolition.

Science is not separated from politics by granting scientific institutions a high measure of autonomy and financial independence. On the contrary, a more intimate relation is likely to result. The issue is like that of the so-called separation of powers in the American Constitution. The fact that the three branches of government are substantially independent of one another in their basis of tenure makes it possible for them to meddle in one another's business more intimately than is possible under the classic parliamentary system.

The denial of sovereignty is not the denial of the government's exclusive right to the legitimate use of force. It is a more pervasive limitation: the assertion of the accountability of politicians to the test of demonstrable facts, and the duty of those concerned with research to bring results to bear on the solution of public issues. Thus science puts partial but significant restraints on the exercise of power. It constrains the arbitrary decisions of either the high official or of mass opinion, and it weakens the hold of ideology on opinion by demonstrating the complexity of issues and the stubbornness of the factual constraints on their solution. Perhaps most important, it helps to redefine issues in terms that may be dealt with pragmatically rather than those that invite irreconcilable conflict.

When such constraints are effective, it is usually not because politicians or the public read scientific reports. Basic research is not translated directly into political decisions, any more than it is into industrial production. It seeps through to political leaders by means of the work of the engineer or physician who sees its relevance to public purposes, and by that of the administrator, who must relate it to political feasibility and competing opportunities. This kind of osmosis depends, of course, not only on the independence of scientific institutions, but on the receptivity of political institutions and administrative systems. A constitutional system in which authority depends on conformity to an ideology can hardly be receptive. A system in which the competition for power depends on a choice between party doctrines and in which policy is developed within closed bureaucracies, is likely to be resistant. In this respect, Americans--who have been keenly aware of the defects of their undisciplined political system--may also be beginning to appreciate the virtue of these defects: a legislature with little party discipline and an administrative system dominated by officials with scientific and professional backgrounds who move back and forth between private and public careers offer little resistance to the redefinition of issues in the light of new scientific possibilities.[22]

In the past, when Americans believed that technological progress was good, this system offered too little resistance to new developments that threatened the environment or the public health. Now, with the new mood among scientists, the picture has changed. Who could have predicted, during the glow of technological pride in America a generation ago, that the development of nuclear power would be ground almost to a halt by the public-interest lawsuits of scientists, or that scientists themselves would take the lead in demanding governmental regulation of basic research in a field like recombinant DNA?

Science has not brought about an "end of ideology." But the new climate of ethical thought within scientific institutions has helped to bring new attitudes into a set of political ideas that had been dominated by a cynical admiration for power and compromise.

The Denial of Scientism If it is important for a scientific institution to recognize that it cannot leave all responsibility for ethical choices to political authorities, it is even more important for it to acknowledge that ethical values can never be derived solely from scientific methods, nor political issues determined by them.

This is not to say that basic values or policies must be determined without regard to science. On the contrary, science can illuminate policy choices by defining the alternative possibilities and evaluating their costs and benefits. As the "situation ethicists" argue, ethical decisions need to be related to the practical context and to probable effects.[23] But beyond the limits of science there remain value choices that call for other types of judgement. This limitation on "scientism" does not depend on (although it is not inconsistent with) a belief in some fundamental philosophical or religious basis for ethics. It has two more pragmatic foundations:

(1) The strength of modern science depends on its ability to deal with specialized aspects of complex reality, usually by a quantitative methodology. Because of this reductionist and specialized approach, any major policy issue needs to be illuminated not by a single science, but by several (or many) scientific disciplines. For example, public-spirited scientists want to help "Third World" countries escape from poverty. But does their development depend on understanding their agricultural techniques, or their command

of industrial engineering, or their public finance systems, or the geological aspects of their water supply and natural resources? Or does it depend on the "Buddhist economics" of the more recent critics of the entire approach to the underdeveloped economies?[24] The modern policy sciences do something to synthesize the disciplines to deal with complexity; but, in the appraisal of any policy, science remains unable to solve the equations of non-commensurable risks and benefits. Selecting the most significant aspects of a problem and the most useful disciplines to appraise them, remains a job that cannot be reduced to a scientific method.

(2) Even more important is the fact that every policy issue involves not only the aspects that a detached observer might define, but also its effect on the distribution of political power. The government official who proposes to regulate genetic research may be motivated by the desire to increase his own importance. On the other hand, the university scientists who object to such government regulation may be equally self-centered in their motivations, as one may suspect if those same scientists have always believed firmly in governmental regulation of private business.

To renounce scientism, a scientific institution is not required to stand aside from public issues. On the contrary, its ethical obligation is to admit that while the knowledge it produces cannot control political decisions, it must make a positive effort to see that its knowledge makes a contribution to the decisions. We are properly concerned with those breaches of ethics by which scientific institutions endanger the lives of others, or defraud one another. Such offenses can be policed to some extent by public authorities. But the positive obligation of science to contribute to the solution of policy problems, without demanding control over them, is an obligation that must depend on the consciences of those who control scientific institutions, for no one else can enforce it. That obligation requires an institution to try to harmonize its special disciplines with others, so that their work will be more applicable to complex public issues. It also requires collaboration with scholars from nonscientific branches of knowledge and with those in positions of political or administrative influence, to insure that science can make its proper contribution to policy issues.

The danger of scientism--the belief that science alone can provide the answers to ethical and political issues--is less to the public than to science itself. By temperament, few scientists are likely to use their expertise to gain political power.[25] But if politicians are persuaded that science is the key to political decisions, they will find it necessary to control science in order to safeguard their own power. If science becomes the basis of an ideology or political religion, it is all too likely to fall under the control of the ideologues. Science may flourish if it is given some stability in a multitude of competing establishments; it would suffer if it became a single established church.

Conclusion

It is no longer possible for scientists to believe that their only ethical obligation is to the advancement of knowledge; the impact of scientific developments on society, and the dependence of research on public support, make the ideal of the ivory tower indefensible. On the other hand, when they undertake to translate their good intentions into effective action, they may find that neither Promethean protest nor participation in national politics gets very good results. They usually do their scientific work as members of institutions, and through the actions of institutions their ethical obligations may often be most usefully discharged. It is at this level of action that one may best go beyond the negative obligation to do no harm to humanity, and help scientific institutions contribute to a balanced polity, in which the quality of science may be maintained, and in ways that make a positive contribution to humane values and democratic responsibility.

The individual's ethical decisions involve difficult compromises between the demands of unselfish love and those of justice, not to mention material necessity--a balance which centuries of casuistry have not defined into specific codes to everyone's satisfaction. An institution's ethical decisions have all these complexities to contend with, and more; its groping efforts toward a balance between the ethic of pure knowledge and that of social responsibility must turn on a recognition that neither in sovereignty nor in scientism will it find salvation.

NOTES

1. Case of Sutton's Hospital, 77 English Reports pp. 937 ff. (Edinburgh: Wm. Green and Sons, 1907). This case is put in the context of medieval theories of corporate responsibility by Harold J. Laski, "The Early History of the Corporation in England," 30 Harvard Law Review 561 (1916-17).

2. Aristotle's Politics (Oxford, England: Clarendon Press, 1931), p. 161.

3. A classification of issues appears in Loren R. Graham, "Concerns about Science and Attempts to Regulate Inquiry," 107 Daedalus 2 (Spring 1978), 1-22.

4. Sissela Bok, "Freedom and Risk," 107 Daedalus 2 (Spring 1978), 115-128.

5. Robert K. Merton, The Sociology of Science (Chicago, IL: University of Chicago Press, 1973), pp. 267-278. See also André Cournand, "The Code of the Scientist and Its Relationship to Ethics," 198 Science (18 November 1977), 699-705; and the report of the Ziman Committee in The Council for Science and Society, Scholarly Freedom and Human Rights (London: Barry Rose Publishers, 1977).

6. Jacques Monod, Chance and Necessity (New York: Alfred A. Knopf, Inc., 1971) pp. 21 and 174.

7. André Cournand, op. cit. (Note 5). See also André Philippart (ed.), Ethiques Contexte Politique Critères de Choix [Textes repris de la revue RESEAUX du Centre Interdisciplinaire d'Etudes Philosophiques de l'Université de Mons, Ciephum, 1975 Numbers 26-27 and 1977 Numbers 30-31], 1977, especially the essays by Philippart and Jean Ladriere.

8. Francis Bacon, The Advancement of Learning, cited in Merton, op. cit. (Note 5), p. 235.

9. For convenient summaries of recent schools of ethical thought, see Richard P. McBrien, "Ethics: A Systematic Exploration," in Gloria Durka and Joan Marie Smith, eds., Emerging Issues in Religious Education (New York: Paulist Press, 1976), pp. 140-148; and Kai Nielsen, "Twentieth Century Ethics" in III Encyclopedia of Philosophy, pp. 81-117.

10. John Rawls, A Theory of Justice (Cambridge, MA: Harvard University Press, 1971), p. 303.

11. Robert S. Morison, "Introduction," 107 Daedalus 2 (Spring 1978), p. xii.

12. See for example Robert L. Sinsheimer, "The Presumptions of Science," 107 Daedalus 2 (Spring 1978), 23-36; and June Goodfield, "Humanity in Science: A Perspective and a Plea," 198 Science (11 November 1977), 580-85.

13. Israel Scheffler, Science and Subjectivity (Indianapolis, IN: Bobbs-Merrill, Co., Inc., 1967), p. 12.

14. Weber's "Science as a Vocation" indeed agrees with Tolstoi that science does not answer some ultimate questions, and that scientists should not abuse their academic status by lecturing students on political values. But his philosophy by no means calls on the scientist to renounce ethical responsibility for the results of his science. H.H. Gerth and C. Wright Mills, eds., From Max Weber: Essays in Sociology (New York: Oxford University Press, 1967), pp. 129-158.

15. Council for Science and Society, The Acceptability of Risks (London: Barry Rose Publishers, 1977).

16. For example, Laurence H. Tribe, "Policy Science: Analysis or Ideology," Philosophy and Public Affairs (Fall 1972), 66-110; and Edward C. Banfield, "Policy Science as Metaphysical Madness," (Washington, DC: American Enterprise Institute for Public Policy Research, 1977).

17. André Cournand, "The Code of the Scientist and Its Relationship to Ethics," 198 Science (18 November 1977), p. 701.

18. For example, see the American Association for the Advancement of Science, Scientific Freedom and Responsibility. [AAAS ad hoc committee report prepared by John T. Edsall] (Washington, DC: AAAS, 1975). A description of a program in the policy sciences that includes attention to ethical issues is given in Derek C. Bok, "Report of the President of Harvard College, 1973-74," LXXII Official Register of Harvard University (1974).

19. Lawrence Kohlberg, "From Is to Ought," in T. Mischel, ed., Cognitive Development and Epistemology (New York and London: Academic Press, 1971).

20. Reinhold Niebuhr, Moral Man and Immoral Society (New York: Charles Scribner's Sons, 1932), chapter 10.

21. This point was developed more fully in D. Price, The Scientific Estate (Cambridge, MA: Harvard University Press, 1965).

22. I refer to the American experience because of my greater familiarity with it. Obviously there are other institutional patterns that reduce the rigidity of ideological control and give science an opportunity to exercise its influence without regard to political parties. The Board of the National Food Administration of Sweden, representing various public and professional organizations with its multi-disciplinary scientific council and final authority on regulatory decisions, is one interesting example.

23. Joseph Fletcher, Situation Ethics (Philadelphia, PA: Westminster Press, 1966).

24. E.F. Schumacher, Small Is Beautiful (New York: Harper and Row, 1973).

25. Kant made both these points regarding philosophers [I assume he included natural philosophers]: that they should not try to exercise power "because the possession of power corrupts the free judgment of reason inevitably"; and there is little danger of their usurping political power "since this class of people are by their very nature incapable of forming gangs or clubs. . . ." See Immanuel Kant, "Eternal Peace" (1795), in Carl J. Friedrich, ed., The Philosophy of Kant (New York: Modern Library, 1949), pp. 456-457. For more recent observations on the temperamental unsuitability of many scientists for political organization, see Gerald Holton, The Scientific Imagination (Cambridge, England: Cambridge University Press, 1978), chapter 7; and Anne Roe, The Making of a Scientist (New York: Dodd, Mead and Co., 1952).

General Bibliography

Bibliography format for periodical articles -- Author. "Article Title." Volume number Periodical Title Issue number (Date): Pages.

Ashby, Eric. Reconciling Man with the Environment. Stanford, CA: Stanford University Press, 1978.

"Between the disclosure of an environmental hazard and political action to control the hazard there is a complex chain reaction of events." Noted biologist Eric Ashby describes, in three lectures delivered at Stanford in October 1977, the varieties of value-conflicts inherent in contemporary resolution of environmental problems--how to inform and alert the public to a hazard in a responsible way, political compromise vs. social needs, maintaining the integrity and usefulness of scientific advice.

Ashby speaks in a clear voice and demonstrates sensitivity to the characteristics of the political environment, as well as the scientific one. He also raises many interesting and important ethical problems--for example, "Is it morally defensible to use shock tactics, to exaggerate, to distort the facts or color them with emotive words, or to slant the television camera in order to excite the public conscience?"

Bandman, Elsie L., and Bertram Bandman, eds. Bioethics and Human Rights. A Reader for Health Professionals. Boston, MA: Little, Brown and Company, 1978.

Contributions from philosophers, physicians, nurses, educators, and lawyers examine the nature and significance of human rights in a biomedical context. Selections are organized around four major topics: (1) the concept of human rights in health care and the ethical issues facing both providers and consumers; (2) the right to life and the boundaries of life; (3) rights of particularly vulnerable populations and responsibilities to those groups; (4) the public's right to health care and the individual's rights within the health care system.

Bezold, Clement, ed. Anticipatory Democracy: People in the Politics of the Future. Introduction by Alvin Toffler. New York: Vintage Books, 1978.

In Spring 1975, over fifty futurists, planners and interested citizens formed the Committee on Anticipatory Democracy to alert Congress to various "citizen futures efforts" developing in the U.S. Subsequent creation of the Congressional Clearinghouse on the Future and the Institute for Alternative Futures provided an institutional framework and the need for this set of articles and resource materials. Anticipatory Democracy (A/D) is a vision that attempts to incorporate a conscious orientation toward the future and the active participation of the citizenry. Groups such as the Alaska Growth Policy Council, Georgia 2000, Idaho's Tomorrow, and others, demonstrate the grassroot support for public discussion of future goals, visions and alternatives. Since much of the change anticipated by A/D is linked to technology, existence of the book (and the A/D movement) may be of interest to those studying public participation in scientific and technical policy decisions.

Braun, Ernest, and Stuart MacDonald. *Revolution in Miniature*. New York: Cambridge University Press, 1978.

Subtitled "The History and Impact of Semiconductor Electronics," this study of the origins of the semi-conductor industry and the dynamics of its growth is a joint venture by a semi-conductor physicist and a historian. In his review [201 *Science* (29 September 1978): 1217-1218] James Brittain lauds the work as "the best monographic treatment of an extraordinary 20th-century revolution in technology that I have encountered."

Broad, William J. "Librarian Turned Entrepreneur Makes Millions Off Mere Footnotes." 202 *Science* (24 November 1978): 853-857.

Provides a profile of Eugene Garfield, originator and publisher of the *Science Citation Index* (and numerous other information-related publications) along with an overview of the use, impact, and limitations of citation analysis.

Broad, William J. "New Laetrile Study Leaves Cancer Institute in the Pits." 202 *Science* (6 October 1978): 33-36.

On the lengthy and strife-ridden process which culminated in a decision by a committee of the National Cancer Institute to make a "half-hearted" recommendation that a clinical trial of laetrile be conducted.

Brown, Lawrence D. *The Formulation of Federal Health Care Policy*. General Series Reprint 334. Washington, DC: The Brookings Institution, 1978.

Federal health policy "results from interplay among five major participants: interest groups, the President, Congress, the Federal bureaucracy, and state and local governments." Brown explores the ramifications and results of this interplay, carrying the question of how health policy is formulated beyond legislative action to bureaucratic implementation. Growing directly "with the size and scope of the federal effort," he asserts, is a "paradox of dissatisfaction" that he calls "responsiveness without effectiveness." Available upon request (accompanied by a self-addressed mailing label) from Publications Sales Office, The Brookings Institution, 1775 Massachusetts Ave., N.W., Washington, DC 20036.

Burrow, James G. *Organized Medicine in the Progressive Era: The Move Toward Monopoly*. Baltimore, MD: Johns Hopkins University Press, 1977.

This history of a crucial era for American medicine, 1900-1917, centers on the re-organization and growth of the AMA and the institutionalization of medical practice and health policy in an effort to discern early influences on current medical attitudes and policies. [See review in 66 *American Scientist* (September/October 1978): 616.]

Caroe, G.M. William Henry Bragg, 1862-1942: Man and Scientist. New York: Cambridge University Press, 1978.

Mathematician, physicist, Nobel laureate, public figure--portrait of the British scientist in his own words and from the perspective of his family. [See review in 202 Science (17 November 1978): 740-741.]

Coggeshall, Porter, John Norvell, Lawrence Bogorad, and Robert Bock. "Changing Postdoctoral Career Patterns for Biomedical Scientists." 202 Science (3 November 1978): 487-493.

Evidence of a shortage of permanent positions in the biomedical sciences is provided by substantial increases in the number of recent graduates who accept postdoctoral rather than permanent positions. Given the situation, the authors ask whether or not federal funds for such positions should be increased, but fail to arrive at a definitive answer.

Committee on International Relations, House of Representatives, U.S. Congress. Science, Technology, and American Diplomacy. An Extended Study of the Interactions of Science and Technology With United States Foreign Policy. Washington, DC: U.S. Government Printing Office, 1977.

Three-volume report sponsored by House Committee on International Relations. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402. 3 vols; 2108 pages; $17.25; Stock number 052-070-04350-4.

"Computers and Social Options." 28 Impact of Science on Society 3 (July-September 1978). Special issue.

Issue focusing on the special impact and influence of computing technologies. Includes articles on "Computer Links Between Government and the Citizen" and "Computers and Developing Countries."

Culliton, Barbara J. "Ethics Advisory Board Confronts Conception in the Test Tube." 202 Science (13 October 1978): 198-199.

Is embryo transfer "research" and thus subject to federal guidelines for human experimentation? Or is it instead "innovative therapy"? Regardless of its classification, is embryo transfer ethical? These issues are the first to be tackled by the newly created Ethics Advisory Board, permanent successor to the National Commission for the Protection of Human Subjects.

Culliton, Barbara J. "Toxic Substances Legislation: How Well Are Laws Being Implemented?" 201 Science (29 September 1978): 1198-1199.

Assesses the problems in administering the Toxic Substances Control Act of 1976, the most complex and far-reaching of the eight recent laws designed to regulate toxins in the environment.

Delbrück, Max. "Mind from Matter?" 47 The American Scholar 3 (Summer 1978): 339-353.

In this succinct essay, Delbruck proposes a theory of the evolution of the human mind and language, and of man's notions of truth, logic, and mathematics. He then investigates the implications of these ideas for the epistemological aspects of science.

Dorfman, P.D. "The Cyril Burt Question: New Findings." 201 *Science* (29 September 1978): 1177-1186.

The work of British psychologist Cyril Burt has had a profound influence on research into the genetic basis of intelligence. One of the most widely quoted studies on IQ differences between social classes is Burt's paper, "Intelligence and Social Mobility," which presented data that were in perfect agreement with a genetic theory of IQ and social class. Recent discoveries of "ambiguities and oddities" in Burt's data have led to charges ranging from "systematic fraud" to "mere carelessness".

This article reports the results of the author's detailed analysis of the data presented in Burt's seminal paper. "These findings show, beyond any reasonable doubt, that Burt fixed the row and column totals of the tables in his highly acclaimed 1961 study, and that Burt's so-called 'actual' frequency distributions were systematic constructions."

Engelhardt, H. Tristram, Jr., and Daniel Callahan, eds. *Morals, Science and Sociality*. Hastings-on Hudson, New York: Institute of Society, Ethics, and the Life Sciences, 1978.

This third volume in the "Foundation of Ethics" series published by The Hastings Center considers the use of scientific views to support or change moral values and the influence of these views on the development of science and scientists. Essays include "Objectivity in Morality and Objectivity in Science" by Alasdair MacIntyre, "The Moral Psychology of Science" by Stephen Toulmin, "Attitudes Toward Eugenics in Germany and Soviet Russia in the 1920s: An Examination of Science and Values" by Loren R. Graham, "Moral Autonomy" by Gerald Dworkin, "Self Conflict in Ethical Decisions" by Eric Cassell, and "Science, Ethics and the Impersonal Passions" by Robert C. Solomon.

Fagen, M.D., ed. *A History of Engineering and Science in the Bell System; National Service in War and Peace (1925-1975)*. Murray Hill, NJ: Bell Telephone Laboratories, Inc., 1978.

This second volume in a series of histories of Bell Telephone Laboratories hones in on "engineering for urgent national-defense applications" from the adaptation of 1930's communications technology for World War II needs, to special communications and military needs of the Cold War. During World War II, Bell pursued over 2000 separate projects for the U.S. government. The outpouring of this new knowledge required trained users and so Bell also established a "School for War Training," which produced over 650 different instruction books for thousands of trainees. The history emphasizes radar and sonar, early analog and digital computers, and the extensive communications work. Part II, on the postwar years, includes descriptions of Sandia Labs and the support for space missions. A 704-page technical history.

Field, Thomas G., Jr. "Science, Law and Public Policy: Meeting the Need in Legal Education." 13 *New England Law Review* 2: 214-232.

The enormous impact of science and technology upon "matters of legal interest" has mandated various strategies and attempts at interdisciplinary communication and education. The author surveys some recent attempts, analyzes some of the possible sources of failure in communication, and concludes that emphasis is needed on the scientific method and its disciplinary implementation.

Finn, Chester E., Jr. *Scholars, Dollars, and Bureaucrats*. Washington, DC: The Brookings Institution, 1978.

Despite the fact that 1977 federal expenditures for higher education approached $14 billion, the U.S. has no comprehensive and unified policy toward higher education. The author examines this complex government-academe relationship and analyzes various suggestions for reform and the impact of government reorganization (e.g., establishment of a department of education). Available from Brookings (1775 Massachuestts Ave., N.W., Washington, DC 20036. 238 pp; ISBN 0-8157-2827-1; $11.95 (cloth); $4.95 (paper).

Geretschlaeger, Erich, and Ingrid Geretschlaeger, eds. *Wissenschaftsjournalismus (Science Writing)*. Annotated Selected Bibliography. Salzburg, Austria: Institute for Science Publication and Communication, 1978.

More than 600 annotated entries reflect the international aspects of concern over the public communication of science. Citation information is given in the language of publication; annotations are written in both German and English. Available for $4.00 (U.S.) from Instituts für Publizistik und Kommunikationswissenschaft, Universität Salzburg, Sigmund-Haffner-Gasse 18/111, A-5020 Salzburg, Austria.

Goldsmith, Robert H. "Changes in the Importance of Certain Popular Science Misconceptions." 78 *School Science and Mathematics* (January 1978): 31-36.

The author (Professor of Chemistry, St. Mary's College of Maryland) replicated a 1940 survey of science educators and found changes in many popular misconceptions about science, at least as perceived by these teachers. Most of the 100 misconceptions are related to health or disease of the human body.

Goodell, Rae, and June Goodfield. "Rorvik's Baby." 18 *The Sciences* 7 (September 1978): 6-7, 30-34.

Like detectives on the trail of an infamous criminal, two noted science writers track down the inconsistencies in Rorvik's *In His Image*. The extravagant plot, the contradictions, the intricacy and implausibility of the procedure, the resources that would have been required, reliance on fortuitous coincidences, critical limitations, and a host of other objections lead Goodell and Goodfield to conclude that it was a grand hoax.

Goodman, David. "Countdown to 1984: Big Brother May Be Right on Schedule." 12 The Futurist 6 (December 1978): 345-355.

According to the author, a scientist, George Orwell's 1984 is proving to be "unnervingly accurate as a forecast of what has happened and might happen in the next 5 years." All of the scientific and technological developments Orwell described have either "already occurred or could occur in the near future, and many of the social and political trends of recent years have been in the direction of his vision rather than away from it."

Graham, Loren R. "How Valuable Are Scientific Exchanges with the Soviet Union?" 202 Science (27 October 1978): 383-390.

In addition to describing the scope of existing cooperative programs between the U.S. and the U.S.S.R., the author analyzes criticisms that have appeared in the press and recommends steps to make the programs more effective.

Green, Harold P. "The Recombinant DNA Controversy: A Model of Public Influence." 34 Bulletin of the Atomic Scientists 9 (November 1978): 12+.

Calls for "candor, openness and willingness to discuss and debate the issues." Green believes rDNA research "will gain long-term acceptance only if the public feels confident that it has been given all of the facts and permitted to make its own judgments."

Greenberg, Daniel S. "Carter Exempts Research from Budget Cuts." Science and Government Report (15 November 1978): 1-2.

Despite his anti-inflation program and his commitment to reduce the federal deficit, President Carter continues to support additional funding for research and development, and has compiled a "presidentially unique track record of speaking out in behalf of spending for science."

Haley, Bruce. The Healthy Body and Victorian Culture. Cambridge, MA: Harvard University Press, 1978.

"No scientific subject can be so important to Man as that of his own life." Nature therapy, spas, water cures, fresh air--the variety of therapeutic treatments and preventative actions taken by the Victorians seems to us today as unsophisticated and faddish. The interest in health, however, incorporated not only dubious treatments and philosophies but also widespread popular demand for information on physiology and psychophysiology.

The model of the "good animal"--healthy in mind and body--embodied an image of national prosperity and soundness, of national virtues and values. Furthermore, as Haley carefully describes, the issues extended beyond the symbolic figure of the British athlete to "fundamental questions about the mind-body relationship and about the relation of natural law to human growth or culture." A host of intriguing chapters investigate these topics within Victorian literature and general culture (one on Carlyle and Spencer may be of particular interest to some STHV readers) in a clearly written narrative.

Holden, Constance. "Science Show for Children Being Developed for TV." 202 Science (17 November 1978): 730-731.

A new television series, designed to expose 8 to 12 year olds to the joys of science, is being developed by The Children's Television Workshop (CTW). The objectives are ambitious: to show science as accessible, rational but also intuitive, neat but also messy; to portray scientists as interesting, patient, rigorous, witty and playful. This article describes some of CTW's research on the TV tastes of preadolescents and how the results are being utilized in the development of the series.

Høyrup, Else. Women and Mathematics, Science and Engineering. Skriftserie fra Roskilde Universitetsbibliotek, 4 Denmark: Roskilde University Library, 1978.

A partially annotated bibliography with emphasis on mathematics and with references on related topics. Author's address: Else Høyrup, Bøgevej 8, DK 3500 Vaerløse, Denmark.

Infeld, Leopold. Why I Left Canada: Reflections on Science and Politics, edited by Lewis Pyenson and translated by Helen Infeld. Downsview, Canada: University of Toronto Press, 1978.

This new translation of autobiographical material by the theoretical physicist presents Infeld's perspective on the politics of Canadian science in the 1940s, his attempt to create a "Canadian school" of theoretical physics, and his move to Warsaw in the 1950s. Essays on the political, social, and psychological pressures within theoretical physics and on the clash of individual and government provide contemporary evaluation of the politics of science following World War II.

Information Services on Research in Progress; A Worldwide Inventory. Washington, DC: Smithsonian Science Information Exchange, 1978.

Data on 179 existing (or emerging) information centers in 53 countries highlight this NSF/UNESCO compilation of information on scientific research in progress. An analysis and statistical overview of world trends in research information collections is complemented by indexes to organizations, system names, persons and subjects. In U.S., copies may be ordered from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161; publication number PB-282 025/AS; $14.50 (hard cover); $3.00 (microfiche). Outside U.S., order from the Hungarian Central Technical Library and Documentation Centre, P.O. Box 12, 1428 Budapest, Hungary; $14.50 (U.S.) plus postage.

"Integrated Technology Transfer." Special issue. 28 Impact of Science on Society 2 (April-June 1978).

The first two issues devoted [illegible] integration of science and technology transfer, with emphasis on [illegible]ping countries. Contents include: "Research co-ordination ar [illegible] agencies in developing countries;" "University-based science a [illegible]logy for development;" "Interdiscipline: search and discovery--system [illegible]ation, application and transfer;" and other articles on energy conservation, technology assessment, microbial technology, and international co-operation.

Johansen, Robert, Jacques Vallee, and Kathleen Spangler. "Electronic Meetings: Utopian Dreams and Complex Realities." 12 The Futurist 5 (October 1978): 313-319.

The consequences--both positive and negative--of technology that will allow "teleconferencing" to replace much of the personal travelling of government and business officials for meetings. Description of the most advanced systems of today, promises of future developments, and discussion of barriers to teleconferencing.

Jones, R.V. The Wizard War: British Scientific Intelligence, 1939-1945. New York: Coward, McCann & Geoghegan, Inc., 1978.

During World War II, Jones worked as the key to the British intelligence effort directed at German scientific research. Using decoded "Ultra Secret" messages, field intelligence, "educated-guess" calculations, British scientists and engineers put their technical skills and training to work in a variety of ingenious ways. In this history of the projects and personalities of the British effort, Jones provides good background for study of the interaction of science and government in the national defense.

Kieffer, George H. Bioethics: A Textbook of Issues. Reading, MA: Addison-Wesley Publishing Co., 1978.

Summarizes the social and ethical issues for both medical and non-medical questions. Major sections examine rDNA, reproductive technologies, human experimentation, health care policy, population growth, scarce resources, and many other current issues.

Krimsky, Sheldon. "A Citizen Court in the Recombinant DNA Debate." 34 Bulletin of the Atomic Scientists 8 (October 1978): 37-43.

A member of the Cambridge Experimentation Review Board describes the board's attempt to balance freedom of inquiry and the public interest in a climate of political confrontation. In the process, he assesses the effectiveness of the science court idea.

Lipsey, Mark W. "Adaptation and the Technological Society: A Value Context for Technology Assessment." 13 Zygon (March 1978): 2-18.

"To fail to reach any consensus about the values that should govern technological development is to risk what some critics fear most, that unchecked technology itself will be the determinant of human values." The guidelines Lipsey develops for judging technological applications are derived from the concept of adaptation. . ."an attractive basis because it encompasses matters of such immediacy and importance--survival and the quality of survival--that they cannot be ignored easily."

Lodge, Terry J. "The 'Windmill Case': Facing Up to Appropriate Technology." 6 Environmental Affairs 4 (1978): 491-510.

Consumers, public utility corporations, and federal public service regulatory policy will all be affected by the outcome of the litigation over an attempt by the occupant-owners of a New York City apartment building to produce their own electricity, using a small windmill-powered electrical generator and the building's existing electrical circuitry, which ordinarily drew its power from Consolidated Edison Co. The article draws some startling conclusions about emerging public policy regarding the rights of individual citizens or small groups to use privately-owned technology to beat rising utility prices.

Maugh, Thomas H., II. "Chemical Carcinogens: How Dangerous Are Low Doses?" 202 Science (6 October 1978): 37-41.

Whether or not chemical carcinogens can be detoxified is unknown. This article reviews the sparse existing evidence as well as the policy implications of each view.

Maugh, Thomas H., II. "Chemical Carcinogens: The Scientific Basis for Regulation." 201 Science (29 September 1978): 1200-1205.

Examines the key assumptions which underlie the framework of toxic substances regulation. While the basic assumptions seem by and large sound, lingering doubts become particularly controversial when regulatory actions threaten established interests.

McGucken, William. "On Freedom and Planning in Science: The Society for Freedom in Science, 1940-46." 16 Minerva (Spring 1978): 42-72.

Protection of the freedom of science emerged as a central concern of the British scientific community in the late 1930s and early 1940s, although prior to the 1930s little attention was given to that issue. This article examines the factors that led to the creation of the Society for Freedom in Science and describes its activities and the responses they evoked both in Great Britain and elsewhere.

Merton, Robert K., and Jerry Gaston, eds. The Sociology of Science in Europe. Carbondale, IL: Southern Illinois University Press, and London: Feffer and Simons, 1977. [See review in 202 Science (20 October 1978): 300-301].

A collection of articles on the academic discipline called "Sociology of Science" as practiced by European scholars. Chapters focus on, for example, Great Britain, France, Germany, and Austria.

Moyal, Ann. Science, Technology and Society in Australia: A Bibliography. Occasional Paper No. 2. Queensland, Australia: Science Policy Research Centre, School of Science, Griffith University, 1978.

The Director of Griffith University's Science Policy Research Centre has compiled a comprehensive bibliography of over 800 references published in and on Australia. Moyal's lengthy introduction provides a valuable review of Australian institutions and science history for those who may be unfamiliar with the country. Available for $2.00 (Australian) from the Science Policy Research Centre, School of Science, Griffith University, Nathan, Brisbane, Queensland, 4111 Australia.

National Academy of Sciences. Proceedings of the Workshop on Retention of Minority Undergraduate Students in Engineering. Washington, DC: National Academy of Sciences, 1978.

Proceedings of a conference conducted by M.I.T. and the Committee on Minorities in Engineering, Assembly of Engineering, National Research Council. The 184-page report may be obtained, without charge, from either the Committee (c/o National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, DC 20418) or from the Office of Minority Education, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA 02139.

National Academy of Sciences. U.S. Science and Technology for Development: A Contribution to the 1979 U.N. Conference. Background Study on Suggested U.S. Initiatives for the U.N. Conference on Science and Technology for Development, Vienna, 1979. Washington, DC: U.S. Department of State, 1978.

The 229-page report to the Executive Commitee, Study on U.S. Initiatives for UNCSTD, National Academy of Sciences (NAE, Institute of Medicine, and NRC). Available upon request from Board on Science and Technology for International Development, National Academy of Sciences, JH 215, 2101 Constitution Avenue, N.W., Washington, DC 20418.

The National Energy Plan; Options Under Assumptions of National Security Threat. Washington, DC: U.S. Government Printing Office, 1978.

This 403-page book discusses the energy problem in the context of an assumed threat to the national security; illustrates available options for government action. Stock number 052-070-04482-9; $4.50.

National Science Foundation. Case Studies in Science Education, 2 volumes. Washington, DC: U.S. Government Printing Office, 1978.

Actual classroom conditions in elementary and secondary schools are portrayed in this two-volume collection of field observations of science teaching and learning in American public schools, 1976-77. Volume 1, "The Case Reports," includes eleven case studies of the practices in a particular school district. (676 pp; $7.25; USGPO Stock Number 038-000-00377-1.) Volume 2, "Design, Overview and General Findings," gathers together the lessons learned from the case studies and assesses the needs of U.S. science education. (518 pp; $6.50; USGPO Stock Number 038-000-00376-3.)

National Science Foundation. Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education. Washington, DC: U.S. Government Printing Office, 1978.

This 516-page report includes tabular data and analyses of state and local instructional guidelines, course offerings, federally-funded curriculum materials, textbook usage, instructional techniques, and facilities. $6.50; USGPO Stock Number 038-000-00364-0.

Nelkin, Dorothy, and Susan Fallows. "The Evolution of the Nuclear Debate: The Role of Public Participation." 3 Annual Reviews Energy (1978): 275-312.

The sources of anxiety and conflict in the public debate over nuclear energy policy have extended beyond technical problems to a "concern with political authority." The authors examine how government agencies have responded to the controversy through attempts to broaden public participation and they suggest the problems with and limits of this type of response.

Neustadt, Richard E., and Harvey V. Fineberg. The Swine Flu Affair. Decision-Making on a Slippery Disease. Washington, DC: U.S. Government Printing Office, 1978.

The authors begin their "post-mortem" of the swine flu campaign by identifying several major flaws in the decision-making for the program. Errors cited include: "overconfidence by specialists in theories spun from meager evidence;" "failure to address uncertainties in such a way as to prepare for reconsideration;" "insufficient questioning of scientific logic and of implementation prospects;" "insensitivity to media relations and the long-term credibility of institutions."

For the reactions of framers of the swine-flu program to the Neustadt-Fineberg report, see Nicholas Wade's article, "1976 Swine Flu Campaign Faulted Yet Principals Would Do It Again," 202 Science (24 November 1978): 849-852.

Nicholson, Heather Johnston. "Autonomy and Accountability of Basic Research." 15 Minerva (Spring 1977): 32-61.

This article offers a comparative analysis of the U.S. government's support of basic agricultural and biomedical research. The author's thesis is that agricultural research is conducted in accordance with a policy of "accountability," while biomedical research is conducted in accordance with a policy of "autonomy."

O'Leary, K. Daniel, and Thomas D. Borkovec. "Conceptual, Methodological, and Ethical Problems of Placebo Groups in Psychotherapy Research." 33 American Psychologist (September 1978): 821-830.

This article raises issues for debate regarding the methodogical adequacy and ethical soundness of placebo controls in psychotherapy research.

Rawls, Rebecca L., and Jeffrey L. Fox. "Women in Academic Chemistry Find Rise to Full Status Difficult." 56 Chemical Engineering News 37 (11 September 1978): 26-32, 36.

More young women are enrolling in chemistry Ph.D. programs, but what are their chances for an academic position? An excellent assessment of the situation in graduate education, tenured academic appointments, salaries, and the attitudes of fellow chemists.

Rettig, Richard A. Cancer Crusade: The Story of the National Cancer Act of 1971. Princeton, NJ: Princeton University Press, 1977.

Documentation and analysis of U.S. legislation that poured significant resources into medical research on cancer.

Ronayne, Jarlath. "Scientific Research, Science Policy, and Social Studies of Science and Technology in Australia." 8 Social Studies of Science 3 (August 1978): 361-384.

In Australia, the size and distribution of the national scientific effort, the lack of widespread recognition of the adverse effects of technology, and lack of support from within the scientific community, have created a climate inhospitable to the development of programs in SSTS (viz. Spiegel-Rösing in Science, Technology and Society, 1977). The author describes the political dimensions of this situation and then focuses on particular aspects of the organization of the Australian research effort, detailing recent initiatives and progress in increasing SSTS programs. (Author is Head of the School of History and Philosophy of Science, the University of New South Wales, P.O. Box 1, Kensington, NSW, 2033, Australia.)

Rosenberg, Nathan, and Walter G. Vincenti. The Britannia Bridge: The Generation and Diffusion of Technological Knowledge. Cambridge, MA: The M.I.T. Press, 1978.

To those of us for whom each crossing of a bridge is an act of faith, the "optimistic oversimplification" of great engineering designs holds its own special wonder. In 1848, engineer Robert Stephenson was commissioned to build a railroad bridge across the Menai Straits in North Wales. Realization of the resulting tubular design--of "unprecedented scale and novelty"--is used as an example of the process of industrialization and the historical learning process. Surmounting a variety of formidable problems and constraints (many prescribed by the Act of Parliament), Stephenson had devised a tubular bridge, constructed of riveted wrought-iron plates and large enough to allow trains to pass through its interior." But the design was so novel that there was no "reservoir of reliable knowledge or experience on which to draw in determining feasibility and. . . safety." In their discussion of the project, the authors assert that the model of engineering which regards technology as essentially the "application of knowledge derived from science" is seriously deficient: "Although engineers obviously draw upon scientific knowledge when it is possible and feasible to do so, their activities are fortunately by no means confined to or circumscribed by such possibilities." The authors, an engineer and an economist, in technical language that should be easily understood by non-engineers, focus on technological change and innovation as a problem-solving activity.

Russell, Louise B. The Diffusion of New Hospital Technologies in the United States. General Series Reprint 322. Washington, DC: The Brookings Institution, 1977.

Ever-increasing hospital costs have been greatly influenced by the large investments made in new medical technologies. The author reviews the trends in technology adoption from 1950-1974 and describes recent efforts in regulation or data collection. Available upon request from The Brookings Institution, Publications Sales, 1775 Massachusetts Ave., N.W., Washington, DC 20036.

Sagan, Carl, F.D. Drake, Ann Druyan, Timothy Ferris, Jon Lomberg, and Linda Salzman Sagan. Murmurs of Earth: The Voyager Interstellar Record. New York: Random House, 1978.

Each Voyager spacecraft--launched by the U.S. on August 20 and September 5, 1977--carries a gold-coated copper phonograph record as a message to possible extraterrestrial civilizations that might encounter the spacecraft. This handsome volume is an account, by the persons who assembled the record, of "why we did it, how we selected the repertoire, and precisely what the record contains." Science interprets our civilization to the universe.

Saperstein, Alvin M. "Science Teaching at the Open University in Great Britain--A Personal Overview." Journal of College Science Teaching (November 1978): 81-85.

The author, who was formerly visiting professor of physics at the Open University, examines an educational situation created "explicitly to challenge all of its society's preconceptions about quality." After extensive analysis (and a good overview for those unfamiliar with the operation of O.U.), Saperstein gives high marks to the direction and motivation of O.U. graduates and calls it a success at what it set out to do: that is, 1) to offer degrees for working adults, on a par with the standards of "regular" British universities; 2) to be open to all, regardless of qualifications; 3) to avoid overspecialization and stress "foundation" courses; and 4) to use modern technology and thereby "make its teaching economically feasible" for all persons in all parts of the entire United Kingdom.

Science and the Congress; The Third Franklin Conference. Philadelphia, PA: Franklin Institute Press, 1978.

Sessions at this May 1978 conference addressed questions of national needs, regulation of science, congressional perceptions of the scientific and technical community, and the requirements for maintaining "healthy" science and technology. Includes transcripts of discussions and addresses by government officials, scientists, and science policy makers. Available from The Franklin Institute, Philadelphia, PA 19103.

Shapley, Deborah. "Intelligence Agency Chief Seeks 'Dialogue' with Academics." 27 Science (27 October 1978): 407-410.

In the wake of four incidents in which the National Security Agency or its employees attempted to classify or limit unclassified research and patent applications, the agency's head has requested a "dialogue" with the academic community over the implications of new research in cryptography and communications security. This article analyzes the reasons for the departure from the NSA's 25-year policy of public silence.

Smith, R. Jeffrey. "Laboratory Chemicals May Come Under Costly OSHA Restrictions." 202 Science (3 November 1978): 496-499.

Whether or not research laboratories should be exempt from regulations governing exposure to chemicals is now being considered by the Occupational Health and Safety Administration. This article outlines the pros and cons.

Soble, Alan. "Deception in Social Science Research: Is Informed Consent Possible?" The Hastings Center Report (October 1978): 40-46.

Soble analyzes various strategies that have been proposed to reconcile the principal of informed consent with the use of deception in some experimental situations. After rejecting the paternalistic and utilitarian agruments for the use of deception, Soble proposes a procedure employing both prior general consent and proxy consent, although he recognizes that the procedure is inefficient and will create impediments to the conduct of research.

Steen, L.A., ed. Mathematics Today: Twelve Informal Essays. New York: Springer-Verlag, 1978.

This nontechnical survey of current pure and applied mathematics includes special articles by many well-known mathematicians, who review recent developments and applications in their specialties. Reviews of number theory, groups, and the four-color problem are combined with descriptions of "The Mathematics of Meteorology," "Mathematics as a Tool for Economic Understanding," and "The Geometry of the Universe" to explore the most active research areas in contemporary mathematics in clear, readable language. A concluding essay by Felix Browder and Saunders MacLane attends to "The Relevance of Mathematics."

Strickland, Stephen P. Research and the Health of Americans. Lexington, MA: Lexington Books, D.C. Heath and Co., 1978.

A penetrating analysis of the relationship among research, health care, and politics. Strickland charges that existing organizational structures and decision-making mechanisms do not facilitate links between scientific disciplines or encourage new avenues of research, but he also cautions that neither wholesale governmental reorganization nor drastic changes in science review procedures are likely to produce magical results. "The challenge is to ensure that traditional organizational arrangements do not so strongly reinforce scientific and bureaucratic conservatism that scientific advance, like budget-making, is foredoomed to be a marginally incremental process."

Thomas, John A.G., ed. Energy Analysis. Boulder, CO: Westview Press, Inc., 1978; Surrey, England: IPC Science and Technology Press, Ltd., 1978.

A collection of papers first printed in the journal Energy Policy (1974-76), which provide a "snapshot of ongoing research," rather than a review of the entire field of energy analysis. The fourteen papers have apparently been reproduced exactly as they appeared in the journal; only a brief introduction is provided by the editor. Contents include several analyses of energy costs (fuels, materials, goods and services), two examinations of the economics of energy analysis, and a final essay questionning the usefulness of net energy analysis (NEA): "as a practical tool for present day energy problems NEA is an elaborate sledgehammer for cracking nuts..." (p.148).

U.S. General Accounting Office. Federal Human Nutrition Research Needs a Coordinated Approach to Advance Nutrition Knowledge. 2 vols. Washington, DC: GAO, 1978. Reports PSAD-77-156 and PSAD-77-156A.

Major report which is available free to university faculty members, students, libraries, and non-profit organizations; $1.00 per volume for all others. For free copies, write to GAO, Distribution Section, Room 4522, 41 G Street NW, Washington, DC 20458. Others, write to GAO, Distribution Section, P.O. Box 1020, Washington, DC 20013.

Vetter, Betty. "New Data Show Uneven Progress for Women and Minorities in Science." 202 Science (3 November 1978): 507-508.

Summarizes the findings contained in the 1978 edition of Professional Women and Minorities--A Manpower Data Resource Service (available for $75 from the Scientific Manpower Commission, 1515 Massachusetts Ave., NW, Washington, DC 20005). In brief: while there has been a rapid increase in education of women and minorities in science and engineering, progress in employment and advancement has not kept pace, particularly for women.

Wade, Nicholas. "Accident and Hostile Citizens Beset Animal Disease Laboratory." 202 Science (17 November 1978): 723-724.

Public apprehension about the safety of experiments at a high security laboratory is heightened by the escape of disease virus from the facility.

Wade, Nicholas. "Senate Passes Back Gene-Splice Cup." 200 Science (23 June 1978): 1368.

Additional maneuvers in the government's effort to find a way to regulate recombinant DNA research.

Walsh, John. "There's Trouble in the Air over Transborder Data Flow." 202 Science (6 October 1978): 29-32.

Information is power: the economic and social implications of U.S. dominance of computer-aided communications technology are a source of increasing tension between the U.S. and other countries. This article spells out the basic issues.

Watson, John G. "The American Science Educator in a Developing Country: A Review of the Literature." 46 American Journal of Physics 10 (October 1978): 971-975.

Systematic review of the literature examining the role of the American Science educator in developing countries--in particular, availability of materials and facilities, expertise of native instructors, and general problems of language and cross-cultural education.

Weizenbaum, Joseph. "Once More--A Computer Revolution." 34 Bulletin of the Atomic Scientists 7 (September 1978): 12-19.

Assesses the social implications of the burgeoning array of "home computers" and of the multi-layered large machines. Weizenbaum asks should computer applications be limited? What irreversible forces are at work and what will be the social impact?

Wood, Fred B., Vary T. Coates, Robert L. Chartrand, and Richard F. Ericson. "Videoconferencing via Satellite: Opening Government to the People." 12 The Futurist 5 (October 1978): 321-326.

Present and planned use by the U.S. Congress of satellite videoconferencing for committee hearings, congressman-constituent discussions, meetings with groups concerned with or affected by pending legislation.

Ziman, John. "Human Rights and the Polity of Science." 34 Bulletin of the Atomic Scientists 8 (October 1978): 19-23.

Definition by scientists of the importance of human rights is seen as crucial to safeguarding the free pursuit of science. (Also see Mark Mellman, "Human Rights: A Different Perspective," in the November 1978 issue of the Bulletin.)

Ziman, John. "Solidarity Within the Republic of Science." 16 Minerva (Spring 1978): 4-19.

A resounding defense of the involvement of scientists and scientific institutions in the human rights movement: ". . .we must redefine the traditional ethic of universalism in science, and reassert the social solidarity in the concept of a 'republic of science.' This solidarity can no longer cohere around the simplified goal of 'the advancement of knowledge,' but must recognize the significance of the social, political and legal conditions under which this goal is sought. To protect both the welfare of the individual scientist and the health of science itself, there must be a direct appeal to the international code of human rights, as a standard of justice, morality, and corporate action."

Zupko, Ronald E. British Weights and Measures. A History from Antiquity to the Seventeenth Century. Madison, WI: University of Wisconsin Press, 1977.

A many-faceted history of British weights and measures, including the social, economic, linguistic, and legal aspects of metrology.

Law&Science

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ARTICLES and COMMENTARIES ON ARTICLES are refereed. To facilitate blind-review, authors are requested to place identifying information on a separate sheet. Manuscripts should be typed, double-spaced, and submitted in duplicate. Prospective authors are invited to communicate with the editors prior to formal submission of articles. ARTICLES should normally be limited to 25 pages, double-spaced; COMMENTARIES or REVIEWS should be no longer than 10 pages, double-spaced.